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MODERN PAPER.

J. 1829.

PRACTICAL REMARKS

ON

MODERN PAPER,

WITH AN

INTRODUCTORY ACCOUNT OF ITS FORMER SUBSTITUTES;

ALSO

OBSERVATIONS ON WRITING INKS, THE RESTORATION OF ILLEGIBLE MANUSCRIPTS, AND THE PRESERVATION OF IMPORTANT DEEDS FROM THE DESTRUCTIVE EFFECTS OF DAMP.

BY JOHN MURRAY,

F.S.A, F.L.S, F.H.S, F.G.S, &c.

WILLIAM BLACKWOOD, EDINBURGH: AND
T. CADELL, LONDON.
MDCCCXXIX.

185.

MODERN PAPER.

tually to happy consequences. I shall feel amply remunerated for whatever trouble the investigation has cost me, should the British public, contemplating the magnitude of the evil and its ruinous effects, be, by its own unqualified protest, effective in the introduction of a more durable and healthier system of manufacture than that now employed in this fabric of that miserable vehicle of manuscript, &c. yclept "paper."

It will readily be perceived that I do not blame the paper-maker so much as I do the purchaser; for the latter stipulating his own terms, without reference to quality, must be supplied in his own way, and on his own dictation; and if one manufacturer will not supply him there are others who will. It is evident the paper-maker must be remunerated, and he has much competition to grapple with and contend against; and it requires not only all the aids that the improvements in mechanical science can supply, but an intermixture of noxious and heterogeneous materials to attenuate the article to the minimum or zero of present prices;—false estimate of economy, and ruinous in its consequences!

The other subjects that I have incorporated with the volume, are admitted by every one to be topics of interest, affecting all classes of the community, and they seem to be important and necessary adjuncts to the present inquiry. The preliminary historical remarks, it is hoped, may be found not altogether uninteresting.

The following pages might have readily been, by a little tact, much extended, and attenuated far beyond their present limits; but this formed no part of my design, being rather anxious to present a condensed view of the question, than amuse the reader by unnecessary diffusion.

I have endeavoured in some measure to relieve the technicalities of the question, by the introduction of occasional disquisition, in order to make the volume more generally acceptable; and, I flatter myself, there will be discovered in it many useful practical hints, which may tend to lessen the evils complained of, and lead to the amelioration of a fabric of such paramount importance as the manufacture of genuine paper, connected as it is with our best interests. For the historical department, I am indebted to a great variety of sources: and, among others, to an "Historical Account of Paper," &c. London, 1800; and HANSARD'S "Typographia," Lond. 1825.

J. M.

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MODERN PAPER,

&c.

CHAPTER I.

PRELIMINARY OBSERVATIONS — EARLY SUBSTITUTES FOR PAPER AND METHODS OF PERPETUATING EVENTS—PAPYRUS.

It would be difficult to single out, among the diversified objects of human investigation and research, a question more curious or interesting than the medium which bears the symbols that register the circumstances and events of past ages, and hands down to us the transactions of primeval time and its intervening periods—the history of a world and all its crowded interest—things that have become the legible symbols of the tablet of mind, and the permanent transcript of thought. It is through such wonderful media that we are introduced into the multitudinous throng of a world's tenantry, and from their inscriptions learn what they thought, and said, and did; and learn, too, the history of their literature and arts—their science and theology. In decyphering these transcriptions of ideas, and memorials of humanity, we virtually converse with minds long since numbered with those who people the world of spirits; and even the mummy, from his cearments, in his sycamore coffin, recovered from the subterranean vaults of eternal pyramids, talks with us by virtue of the roll of papyrus, and its pictured inscription which he holds in his hand. And the Christian, too, thus receives the all important revelation "touching the law of his GOD."

These tangible symbols, we are of opinion, could only have come originally from Heaven; all else of history must have been transmitted by oral tradition or the songs of the bards; for it seems scarcely conceivable that the wit or ingenuity of man could invent a method by which mind could send a picture and portrait of itself to mind, or by which we could obtain the image and superscription of the mind of our Creator—" GOD OVER ALL." The theatre of this important legacy to man was MOUNT SINAI.

We are informed by the sacred historian, that GOD gave unto him, " when he had made an end of communing with him on Mount Sinai, two tables of testimony,—tables of stone, written with the finger of GOD;" and we have elsewhere the additional information, that " the tables were written on *both their sides*, on the one side and on the other were they written; and the *tables* were the *work of God*, and the *writing* was the *writing of God*, graven on the tables." This description is very circumstantial and definite. The word which has been translated " graven " is very different in its import from the meaning we now attach to it, and we are therefore not to infer that the characters of the Decalogue had any similitude to the " engravings of a signet," as now understood, nor can we determine with precision whether the names of the Children of Israel, which were *graven* in the twelve gems set in the Breastplate of Judgment, were worked in *intaglio*, or in relief in *cameo* form. Mount Sinai, if we have been rightly informed, is a granitic rock: and I possess a fragment of red graphic granite, brought to this country by the late lamented traveller BURCHARDT. It seems probable to me that the composition of the two tables of stone, "the work of God," was of the curious description of granite known to the geognost under the name Hebrew or graphic granite. I have several beautiful specimens, both of the red and white varieties, independent of that found by BURCHARDT in the peninsula of Sinai, which Earl MOUNTNORRIS had the goodness to present to me *. In this interesting species of granite the mica is altogether absent, and the imbedded crystals of quartz, which bear a singular and striking resemblance to the Hebrew character, are arranged in straight parallel lines, and are of different sizes in different specimens. Now, granite is a *primitive* rock, and may be emphatically and truly termed the foundation-stone of the globe,—admirably emblematic of the permanence and stability of the words of the law. Altogether, it seems to me not unlikely that graphic granite formed the material of the tables of stone, and that, under the plastic touch of the Omnipotent fiat, the very texture of the stone, "the work of God" in the beginning, was so modified as to represent a transcript of the "words of the law" in the Hebrew tongue. This view of it seems, however peculiar it may be considered by some, conformable to our most exalted views of an Omnipotent Creator. Its characters were therefore an integrant part of the stone, and identified with it; seen on both sides; nor could these sacred characters, "written by the finger of God," be obliterated but by the actual decomposition and ruin of the stone,—illustrative that not "one jot or one tittle should pass away" till "the mountains should be removed, and there be no place found for them."

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* I have also in my cabinet a rich specimen of orbicular, or Tyger Granite, from the Island of Corsica,—a kind, we presume, still more rare.

In the sacred text, we are further informed, that great stones were directed to be set up by the Children of Israel, after the passage of the Jordan, in Mount Ebal; and, being "plastered with plaster," thereon were to be written "all the words of the law very plainly." This proclamation, in all probability, was a copy, or fac simile, of the inscription on the two tables of stone which the Jewish Legislator is said to have also transcribed, and given orders that "this book of the law should be put in the side of the ark." We are told, that in obedience to the commands of MOSES,—JOSHUA, the High Priest and Leader of the Armies of Israel, faithfully obeyed the injunctions of his predecessor, and built an altar in Mount Ebal, of unhewn stones, in order to distinguish it from the heathen altars around, which were constructed of hewn stone, "and he wrote there, upon the stones, a copy of the law of MOSES; which he wrote in the presence of the Children of Israel." This inscription was afterwards read *viva voce* in the audience of the camp, including "the strangers that walked among them." JOSHUA before his death, after the example of MOSES, "made a covenant with the people," and, having transcribed its conditions in "the book of the law of God," he set up a great stone under an oak, that was by the sanctuary, as a record of the solemn transaction, and a witness between the contracting parties, as was the case between the Patriarch Jacob and Laban [*].

In the book of Job, which has by some been supposed to be written by Moses, we have an obscure intimation of the method employed in this registry on the rock. "Graven with an iron pen and lead in the rock for ever [†]." *Tools* having been mentioned previously, the *iron-pen* may be considered as a kind of sculptor's chisel; and the letters and words were probably hewn in the rock, as we perceive to be the case with the Sigean inscription, engraved on a pillar of snow-white marble, and considered to be upwards of 2360 years old, or with the hieroglyphic symbols which are sculptured on the obelisks of Egypt. The *lead* mentioned in association may refer to the "book" alluded to in the preceding verse, in which he wished to have recorded the language of his complaint; and we find leaden tablets in very early use. We are informed by Pausanias, that the "Opera et Dies" of He-

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[*] See for the preceding remarks, as authorities, Deut. xxvii. 2. et seq.; xxxi. 9. et seq. Josh. ix. 32, & xxiv. 26.

[†] Job, xix. 23.

SIOD were written on lead. We have also the authority of PLINY, that lead, rolled up in a cylindrical form, was used as writing tablets. Thus HERTIUS, wrote to DECIUS BRUTUS, on leaden tables or plates; and, in Italy, were preserved two documents of this kind of Pope LEO III. and the king of the Longobards, LUITBRAND. According to KIRCHER, these leaden memorials were not unfrequent. Thus MONTFAUCON notices a very ancient book, composed of eight leaves of lead, containing many mysterious figures of the Basilidians, and words, partly composed of Etruscan and partly of Greek characters. The first and last of these leaves formed the cover; to the back of this curious document, were rings, attached by means of a small leaden rod, to fasten the whole together; pure lead seems admirably adapted as the medium of a permanent register. Thus we find that the Etruscan vases, which are of pure lead, retain the beauty of their enchasements unimpaired until now. While the characters on the columns and pilasters at Persepolis appear to have been engraved, those on the bricks obtained from the superb ruins of ancient Babylon seem to have been stamped, or printed with a mould. In the very interesting cylindrical brick, preserved with such judicious care in Trinity College Library, Cambridge, the letters or characters appear to have been communicated to the substance in a semi-indurated form, and then the brick was "burnt thoroughly;" just as we believe the little Egyptian idols to have been; for, in a small figure of Osiris, in my possession, the hieroglyphic characters on the back and front seem evidently stamped in, the glaze applied, and then submitted to the action of heat, which has produced a semi-vitrification *. Thus, too, have we observed the name of the potter stamped in the earthen lamps found among the ruins of Pompeii. The Babylonian brick at Cambridge, which I have minutely examined, is about seven inches long, and three inches diameter at each end, and its form is that of the prolate spheroid, or the figure of a barrel. Its age cannot be determined with certainty, but may be conjectured at not less than 3000 years.

The very interesting researches of Dr Young and Mr Salt, on Egyptian hieroglyphics, but

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* Mummy beads are not glass, but seem formed of biscuit ware, covered with semi-vitrified glaze, the agency of heat.

especially those of M. CHAMPOLION, in this new science of literature, have very much curtailed the lofty claims of antiquity assumed for the obelisks of Egypt, as well as the planisphere of Dendera, and reduced them to their proper dates. The hieroglyphic alphabet, constructed by CHAMPOLION, seems completely verified by the inscriptions on the stone brought from the Island of Philoe, which contains not only the sacred symbols or hieroglyphics, but the enchorial character, and the ancient Greek inscription,—a practice corroborated by the inscription which PILATE affixed to the cross, which, we are informed, " was written in Hebrew, Greek, and Latin." A similar inscription, we are also informed by Dr WALSH, was affixed to the wall in the court of the Seraglio, when the head of ALI PASHA was exposed in a charger to the gaze of the populace. What are called Sarcophagi, as those stated to be the tomb of ALEXANDER, &c. now in the British Museum, we presume to have rather been monolithic temples; in which opinion we are warranted by similar views entertained by Earl MOUNTNORRIS, the Abyssinian traveller, then Lord Valentia. That rich arragonitic gem the Soros, brought from the tombs of the kings to this country by the late Mr Belzoni, has its hieroglyphic symbols sculptured and coloured with a blue frit. It is now possessed by a private individual, Mr Soame, the funds of the British Museum being insufficient for the purchase of this unique relic of antiquity, rescued, it is probable, from a period when Nebuchadnezzar reigned in Babylon, or the Prophet Isaiah uttered the inspirations of prophecy. We rejoice, however, that the patriotism of Mr Soame has been enabled to secure to this country at least a temporary possession of it, when foreign kings were contending for the prize. It is supposed that it once shrined the body of Pharaoh Necho; it is of that kind of carbonate of lime called arragonite; and Dr Wollaston imagined that it once hung a stalactitic pendant from the roof of some cavern. It is covered within and without with hieroglyphics; is completely translucent, and, when struck, rings like a silver bell.

It appears to me by no means unlikely, that the Pyramids of Ancient Egypt were once "plastered over with plaster," and that on this surface was inscribed, in hieroglyphic symbols, their laws and religion, like unto the monument which was reared in Mount Ebal, and intended as a *codex perenne* of their civil institutions and religious rites, a book ever open to all the people. The sculpture of the Obelisk, however, has out-lived the al fresco inscription of the pyramid. Whether the summits of the pyramids, as in the case of similar monuments in Mexico, ever smoked with the sacrifice offered in oblation to heaven, as in the case of the altar of Mount Ebal, we cannot tell; but it is not improbable; and we think the hypothesis that this monumental mass merely enshrined the Bull *Apis*, or the *Golden Calf* of the sacred volume, just as far fetched as that of my late friend Dr CLARKE, the eminent traveller, who was desirous to prove that one of these pyramids contained the bones of him who once rode in the second chariot of Egypt, second only to the king, and was embalmed, "and put in a coffin in Egypt;" that on the exode its sanctuary was violated, and its inner recesses ransacked, in obedience to the oath, that Joseph required of the Children of Israel, that on their departure they should surely "carry up his bones" from thence. We have the authority of friends who have visited, and attentively examined, and attained the summits of these interesting monuments of antiquity *, that they must once have been "plastered over with plaster," for several fragments still remain attached, and we cannot well conceive of a nobler temple thus richly encrusted with symbols, emblematic of their religious rites and ceremonies, and the mystics and mysteries of mythology. The fires that blazed upon their lofty summits pointed to heaven, and their inscriptions, "seen and read of all men," enshrined the volume of their creed.

Thus, it would appear from Sacred History, the only authentic record of primeval time, that insulated pillars or huge stones were the sole memorials of great or important events. To these unlettered documents, succeeded symbolic and lettered sculpture on rocks and obelisks. Tablets of stone were not only characteristic of the pa-

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* By specimens obtained from these mighty structures in my possession, which Lord MOUNTNORRIS had the goodness to present to me, the stones which compose them seem to be consolidated masses of the *vertebræ of the Jelly Fish!*

triarchal age, but are now found in South America,—the Land of Montezuma, as well as on the Plains of Hindostan. To inscriptions on the rude rock succeeded those on metals, and the leaves, and bark of trees, as well as the skins of animals. We are all familiar with the Obelisks of Egypt, and their hieroglyphics, &c., and on the pillars of Mercury Trismegistus his doctrines were engraven in similar symbols. We are informed by PORPHYRIUS that the sacrificial ceremonies of Cybeles, were sculptured on some pillars in the Island of Crete, and in the time of DEMOSTENES, there was still existing a stone, on which the code of laws was engraven. Both sacred and profane history, therefore, unite in their verdict, that this was the most antient method of recording the history of events, and registering laws, and the mysteries of religion, &c. According to PLINY, the Babylonians registered their astronomical observations on bricks, and the ostracism or acts of banishment of the Athenians were communicated to fragments of pots and oyster shells; hence the origin of the name.

The Sigeum inscription has been referred to, and this stone now lies before the porch of the Greek church in Jeni-Hissary, where it is used as a seat: it was copied by Mr SHEPHARD, British Consul at Smyrna, and subsequently by M. LISLE. It simply records a donation by HERMOCRATES to the Sigeans, a presentation in the common hall, of a cup and its stand and wine strainer. It reads from left to right. Still more ancient inscriptions on stone have been discovered at Amyclæ, and are now in the Royal Cabinet at Paris; but, contrary to the Sigean inscription, the letters read from right to left. The decrees of Lycurgus appear to have been sculptured in stone. The convention between Smyrna and Magnesia, was recorded on marble 270 years A. C., and the Jus Publicum of the Athenians was engraved on stones of a triangular form called *Cyrbes*. In the gallery of the Grand Duke of Tuscany at Florence, we have seen numerous Roman, Greek, and Etruscan characters on marbles, urns, vases, &c. as well as inscriptions on *terra cotta* used by the Etruscans.

The use of lead as the material of the writing table, in reference to the passage which occurs in JOB, has been already referred to, and bronze seems to have been subsequently in general use on the authorities of CICERO, LIVY, PLINY, SUETONIUS, and others. On the bronze kettle, the votive offering of CADMUS to MINERVA at Lindus on the Island of Rhodes, Phenician letters were inscribed. Those which are on bronze, and still preserved, are the *Scriptum de Bacchanalibus*, TRAJAN'S *Tabula alimentaria*, and the helmet found at Canna, which last contains Punic letters. In the year 1444, on the removal of some of the ruins of an amphitheatre in the town of Gabbio, eight bronze tables were discovered in a subterranean cabinet: seven of these contained Latin inscriptions, the eighth was in the Etruscan language. Other bronze tables have been discovered in Tusçany, and the speech of CLAUDIUS, engraved on twelve bronze plates, sufficiently legible and distinct, are preserved in the Maison de Ville at Lyons, where we have seen them. The laws of the Romans were, it has been stated, originally inscribed on tables of oak, but according to others, on ten tables of ivory; and after having been hung up for the approval of the people, were finally engraved in bronze, which, however, was melted by the conflagration of the Capitol, which was *set on fire* by lightning. The laws of the Island of Crete were engraved on bronze; and on the election of the Athenian Magistrates, the names of the candidates were written on bronze, and the suffrages obtained by lot, in which black and white beans were used; and on withdrawing these plates from an urn, the one accompanied by a white bean became the successful competitor.

We find also other metals used for a similar purpose. Brass was employed in transactions among the Jews, Spartans, and Romans: the discharges of soldiers written on copper are not rare antiques. A deed gift in Sanscrit on copper, dated 100 years A. C., was discovered at Mongheer in Bengal. In the King's library at Hanover, is a letter from a native prince of the Coast of Coromandel to GEORGE II., engraved on a plate of gold, inlaid with diamonds on the two narrow sides: it is nearly three feet long, and four inches wide. There has been a variety of other substances used as substitutes for paper. Thus there are writing tablets of ivory, and of wax, and even the backs of tortoises have been used. The Arabians we are told perpetuated, by notches on the shoulder bones of sheep, their remarkable periods and events, and after tying them with a string suspended their chronicles in their cabinets. Thus, too, MAHOMET is said to have employed scribes, as the impostor could not write, to transcribe the pretended revelations of the Divine Will to him at different and distant periods of his life. The palm-leaves, skins, and bones, on which they were inscribed, were thrown *en masse*, without any order, into a trunk, and committed to the custody of one of his numerous wives; and it is supposed that ABUBEKER, who as Caliph succeeded MAHOMET, had these curious documents copied.

Subsequent to these unbending materials we find others of a more pliable texture, employed for writing on, as the skins of animals, and the bark, wood, and leaves of trees. Several oaks were cut down in Sherwood Forest in 1786 and 1791. In one of these were the letters I. and R. for King JAMES, which seem to have been cut in the tree. These characters were discovered about one foot deep in the tree, and one foot from the centre: another had the letters W. M., with a crown, (WILLIAM and MARY), and these were about nine inches deep, and three feet three inches from the centre of the tree. A third specimen had the letter I., with a blunt radiated crown (King JOHN); it was eighteen inches within the tree, and about a foot from the centre. In the first of these, the outer plate, or cylinder of wood, had the letters in relief, while the counterpart had the impression as if stamped in the wood. Where the bark had been stripped off for cutting the letters, the wood that had grown over the wound, was not found to adhere to that particular part; but easily separated of itself, when the wood was cut in that direction. We presume that inscriptions on living trees may have been a very ancient practice. Trees we know were planted to commemorate events; thus the oak, &c., and hence perhaps the name "DEBORAH's palm," &c. and at this day the Turks, and other Asiatic nations, plant trees in their cemeteries on the death of any of their family; thus the *cypress*, *yew*, &c.; and to celebrate "the day of their espousals," or the natal day of their children. We do not see any reason why they may not have been occasionally inscribed to memorialize events, and deeds connected with individual and national history. An inscription for instance, on the succulent leaves of the *Agave Americana*, might perpetuate an event for centuries or ages to come. Box-wood and ivory appear to have been used at an early period. We read of writing tables in the Sacred Volume, as in ISAIAH, HABAKKUK, &c.; and such may be supposed to have been of wood. The laws of SOLON were written on boards, and made to revolve so as to be brought into view. In the fourth century, the laws of the Emperors were painted with ceruse on wooden tables, and the Swedes seem to have had the same custom. These laws are still called Balken, from *Balken* a balk or beam, on which they were originally transcribed. In the *Laxdaela Saga*, it is recorded that OLOFAT built a large house at Hiardarhalt, on the balks and spars of which he had carved the history of his own and more antient times, and THORKIE HAKE wrote his own deeds in hieroglyphic characters on his chair and bed, and we have noticed curious carvings registering circumstances, on the houses at Unterseen in Switzerland.

At a very early period in their history, the Greeks and Romans used either plain wooden boards, or boards covered with wax. When they were not covered with wax, the Greeks called them *Shedulæ* or *Schedæ*. Hence our word *Schedule*, which signifies a little inventory or scroll. According to the authority of BARONIUS, the Gospel of St MATTHEW, in the Hebrew tongue, written on such tables, was found in the grave of BARNABAS. In the Gospel of LUKE, a "writing-table" is mentioned. When the boards were overlaid with wax, they were called often *cera* simply: hence the expression *cera prima*, or the first page, and so on. The Romans commonly used bees-wax to cover the boards with, and sealed them in linen cloth. In the archives of Hanover, there are twelve such boards, covered with bees-wax, on which the names of the inhabitants of the houses are enrolled. These twelve boards form twenty-two pages, the outer tables, apparently of beechwood, forming on one side a page, and on the other the boards or covers: thus, too, the term *boards* as applied to a book with covers. This manuscript book is about a foot and a half high, eight and a half inches wide, and five and a half inches thick; so that each leaf is consequently about half an inch thick. We find similar waxen tablets of manuscripts at Florence, Geneva, &c. The higher classes among the Romans employed thin plates of ivory, called *Libri eborci* or *elephantini*. MARTIAL and others have decided that ivory tablets were in use, though some have supposed that *Libri elephantini* were employed to denote their magnitude or size, as we use the terms elephant-quarto, or elephant-folio.

The Chinese, in very ancient periods, wrote with iron tools on boards, on the bamboo reed, and on metallic surfaces. The Persians and Romans, at an early period of their history, wrote on hides, after the hair was removed; and the shepherds of a former age wrote their lays with a thorn, or awl, on scraps of leather, which were wound round their crooks, and might thus literally be called a *roundelay*. According to PURICELLI, a grant from the Italian kings HUGO and LOTHARIS to the Ambrosian Church at Milan, was written on the skin of a fish. In the library of PTOLOMAEUS PHILADELPHUS, were the works of HOMER written on the skins of animals, in letters of gold. Similar manuscripts were in the library of ZENO ISAURICUS; and there was burned in the reign of BASILISKUS, at Constantinople, a manuscript of the works of HOMER, written in letters of gold, on the skin of a serpent, 120 feet long.

The leaves of trees appear to have succeeded these singular materials, such as the fan-palm, cocoa-nut, olive, poplar-leaves, and others. The Egyptians, according to the account of PLINY, first used the palm-leaf; and books written on it are still preserved. The natives of Malabar, and other eastern countries, still write on the leaves of the Corypha umbraculifera, or great fan-palm; and I possess a specimen of this description, bearing, if I mistake not, the Cingalese character. It appears to have been written with a pointed metallic substance, in all probability an iron style or pen, and carbonaceous matter, mixed with gum, rubbed into the letters. At Göttingen, Copenhagen, and Halle, there are bibles written on the leaves of the palm. It is not improbable that they were used in Palestine as a substitute for paper, seeing the tree was by no means rare in Judea. It grew between Rama and Bethel; hence DEBORAH'S palm-tree and

Jericho was also called the "City of Palms," from the numbers around, chiefly, we believe, the *date-palm*. In VESPASIAN'S coin, the *Judea capta*, the captive daughter of Sion, is seen to weep under the palm; and, as it is in fruit, cannot be mistaken. The Braminical manuscript sent from Fort St George to Oxford, is on palm-leaves. Indeed various Asiatic nations, as those of Ceylon, and others, write on the leaves of different palms. The people of Syracuse wrote their sentence of expatriation on the leaves of the olive tree; and the same leaves were used by the Athenians, in the case of exclusion from the senate. Poplar leaves were employed in sacred writings. Hence PYTHAGORAS terms it *Sacred*. The inhabitants of the Maldivian Isles, write on leaves of the macarcquo tree. In some parts of the east, those of the Musa paradisiaca have been used; and in Java they write on the leaves of the lanter tree. Sometimes the leaves of the cocoa-nut, taon-conder, and other trees, are used; and from the ancient practice of writing on leaves of trees, we say the *leaves* of a book. In process of time, the bark of trees was used, such as the elder, elm, birch, &c. especially the liber or inner bark. Hence the name *liber*, the Latin word for book, and library. Such books could be conveniently rolled up, and carried on the person; and, in this form, it was called *volumen*; hence our word *volume*. The term *codex* having been applied to several of these sheets put together, from caudex, the trunk of a tree, is the source from whence the word *code* is derived. Cragus mentions having seen in Switzerland a fragment of Virgil, written on the bark of the birch: the ancient song ascribed to Elsa, the daughter of Andres, was termed the "Birch Song," because originally written on the bark of the birch. Montfaucon makes mention of a document inscribed on bark: the date appears to have been originally inserted, but a mouse seems to have knawed and obliterated it, and it is interesting, from being one of the earliest charters in which the computation of the Christian era has been used. In the British Museum, are several manuscripts on the interior and outer barks of trees; and in that emporium of ancient literature, the Vatican, are various manuscripts on bark, in different languages. Characters were sometimes painted on cloth of linen and cotton;

and, according to some, the prophetic inspirations of the Sybils were communicated to cloth; but it is more reasonable to presume, that the Sybiline leaves were formed of the papyrus. The Chinese of antiquity employed pieces of silk or linen; Count CAYLUS informs us that characters on *linen* have been found in mummy cases, but we doubt this very much: it is questionable whether cloth of linen was known to the ancient inhabitants of Egypt. A fine specimen of cloth in my possession, taken from a mummy, and in a state of high preservation, is evidently made of *cotton;* and, as for the "fine linen," or *Sindon* of the sacred text, there seems nothing determinate or certain. Skins and intestines of various animals, as those of sheep, goats, and asses, after being tanned, were used; and, in the Vatican at Rome and Bibliotheque du Roi at Paris, are various manuscripts on them. Memorandum-books made of asses skin, are in use even in modern times. In the convent of the Dominicans, at Bologna, are two books of ESDRAS on asses skins, at least 500 years old.

The papyrus of Egypt has been the chief source of ancient paper; the precise date at which this species of paper was introduced is unknown; according to some, it was first made at Memphis; and, in the opinion of others, in Upper Egypt, at Seide. "The paper-reeds by the brooks*,"—by the mouth of the brooks, mentioned in the sacred volume, is sufficiently descriptive at once of their character and of the use to which they were applied; and here is a date 714 years A. C., when ISAIAH wrote the prophecy which bears his name, and it proves that the papyrus was then used for writing on, *i. e.* 2500 years ago: and this interesting plant, the *Papyrus antiquorum* of modern botanists, was first introduced into this country in 1803, flowering from July to September. It grows near the Delta of the Nile, or, as it is in our translation, "by the mouth of the brooks," and on the verge of the Mediterranean. We have seen a fine plant of this kind, luxuriant and tall, growing in a pot of water, without soil, in the lecture-room of the Botanic Garden of Edinburgh. There appears to be more than one species, and they may have been sometimes confounded. According to STRABO, the true papyrus grew only in Egypt and the East Indies; and though the papyrus grows in Sicily, called there *papyro*, and forms a beautiful ornament on the banks of the Anapus, JUSSIEU is of opinion that they are essentially different, and that the Sicilian variety was not used by the ancients. The *Cyperus niloticus* was of a different kind, and is in all probability the *bulrush* of Scripture, which was used for the construction of boats, a fact mentioned by PLINY, and illustrating the extraordinary expression we meet with in Scripture—" vessels of bulrushes upon the waters *." But we have the authority of Earl MOUNTNORRIS, that vessels formed of the " *Cyperus niloticus* " are not unfrequently used in navigating the inland waters of Abyssinia. They are united to a keel of acacia wood, and pitched with bitumen, within and without: in a small boat of this kind was the infant legislator of the Jews exposed on the mighty stream of the Nile. According to PROSPER ALPINUS, it was called *Berd* by the Egyptians: the following is his description of the plant. "Papyrus quem berd Egyptii nominant est planta fluminis Nili binis aut pluribus caulibus rectissimis supra aquam sex septemque cubitibus assurgens. Caulemque in fastigiis scapus innumeris capillamentis longis rectisque contextus cernitur *." In the narrow, but fruitful, valley of the Nile grows the papyrus, in marshy grounds or swamps on the borders of that river as well as at its embouchure, and Delta. It rises to the height of twelve feet, and is crowned with a bushy tuft or feathery head; the stem is altogether void of leaves, though there are a few short ones at the lower end. From the inner rind of the stem, according to PLINY, who describes the process, the ancient paper was formed, and it seems to have been in high estimation in the time of ALEXANDER the Great; but perhaps it was not known long before, or, at any rate, had not been brought to such high perfection and reputation as it then attained, or it might not have been so plentiful, as PTOLOMY PHILADELPHUS, King of Egypt, when he began to form a vast library, and to collect books from

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* Is. xix. 7.

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* Is. xviii. 2.

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* PROSPERI ALPINI de Plantis Ægypti. Venetii 1592.

every quarter, had them copied on paper made of papyrus.

This interesting species of paper was chiefly manufactured at Alexandria, from the export of which the city was greatly enriched; and VOPISCUS, in the time of ADRIAN, makes mention of a person called FERMIES, who made it his boast that he could maintain an army from the value of his stock of paper. As late as the end of the fifth century it was in general use throughout Europe, and did not entirely disappear in Italy till the eleventh, nor was it discontinued in France until the twelfth century. The word *Paper* or *Papyr* is derived from papyrus.

According to PLINY, the internal parts of the bark of the papyrus were those that were exclusively made into paper. Slips of various lengths, and as many as could be obtained, separated by an iron point or the edge of mussel-shells, were placed with their edges in contact, and with transverse slips superimposed on them, these were also placed in contact, and the whole having been sprinkled with the water of the Nile, was subsequently submitted to the influence of powerful pressure, by which means the edges of the strips were made to cohere completely, and, being hung up to dry in the sun, were afterwards smoothed and polished with an ivory tooth or a shell, to prevent the ink from running; and the papyrus was then complete. In the year 79 of our era, a species of papyrus, in all probability identical with the *Papyrus antiquorum* of the Nile, and equally valuable for the purpose of making paper, was found on the banks of the Euphrates, near to Babylon. The Chevalier SAVARIO LANDOLINA of Syracuse has made some very good paper from the papyrus of Sicily; and we have seen beautiful specimens of this modern manufacture in the Studio of Naples, and compared their texture and general appearance with those of ancient papyri, and they seem to bear a remarkable resemblance, scarcely to be distinguished from those of antiquity. A specimen, sent to this country by LANDOLINA, may be seen in the British Museum. Dr JOACHIM SCHOUW of Copenhagen, with whom I had the pleasure to become acquainted at Naples, after his return from Sicily in 1818, described the process to me, as communicated to him by the Chevalier. The method employed was somewhat similar to that described by Pliny, but the *medulla*, or pith, of the Sicilian papyrus, was the part used, which, after being separated into thin slices, was in a fresh and recently cut state brought in contact by the edge; transverse slips, in like manner, with their edges together, were placed over these, and, having been moistened by a glutinous liquid, were submitted to the influence of a press; and from an examination of the structure of the medulla of the *Papyrus antiquorum*, and parting it into slips, &c. I feel no doubt on my mind but the medulla may be manufactured into a tissue resembling the papyrus of the ancients. He also informed me, that he found the plant growing plentifully in the marshy grounds, and near rivulets around Syracuse in Sicily. The papyri found in mummy cases seem to have been manufactured in a similar way; the transverse ribs at almost right angles with the others prove that transverse slips must also have been employed, and the numerous specimens I have examined, both of those recovered from the ruins of Herculaneum, and found in mummy cases, appear to me every way identical. Fine specimens of Egyptian papyri have been brought to this country by BELZONI, SALT, GREY, and others, and some contain not only the sacred or hieroglyphic characters, but the enchorial and ancient Greek, and thus can be easily decyphered; while the Greek inscription becomes the key to the enchorial characters and hieroglyphic symbols of Ancient Egypt, it validates CHAMPOLION'S Hieroglyphic Alphabet. Some of these curious documents refer to the purchase and transfer of property—the title-deeds of land. It is stated, that the Swedish Consul at Alexandria is in possession of a very fine roll of papyrus, which appears to have been used as a deed of purchase 102 years A. C. Mr BRUCE, the Abyssinian traveller, was possessed of a large and perfect manuscript in papyrus, which had been dug up at Thebes; the covers, or boards for binding the leaves, he informs us, were of the root of the papyrus, covered first with coarse pieces of the paper and then with leather. The finest roll of papyrus I have ever seen, is that in the possession of Earl MOUNTNORRIS, which his lordship emphatically calls *Editio princeps.*

The most interesting and extensive collection of papyri are unquestionably those recovered from the ruins of Herculaneum *, which are now to be seen in the apartments allotted to them, in the Studio at Naples, and I particularly examined them when there. In their present condition, they merely resemble sticks of charcoal, and when let fall, have a similar metallic ring, and the writings on them are composed of a mixture of Greek and Roman characters; the number originally brought to the museum amounted to 1696; 88 of this number have been unrolled and found legible, and two dozen have been presented to foreign powers; 319 have been operated upon, but found illegible. Sir H. Davy considered that only from 80 to 120 of the others afforded any ulterior chance of being unrolled. He does not, from some unfortunate misunderstanding, appear to have been permitted to make any chemical experiments upon them, and chemical means alone seem likely to be followed by success. A moment's reflection on inspecting these papyri must convince that they are not charcoal, the consequence of the powers

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* Those discovered among the ruins of Pompeii, from the access of air, are in a state of sad degradation, and soon crumble away.

of fire, but are rather in a state approaching to that of Brown Bovey Coal. Their characters are of a much more intense black than the ground on which they are inscribed. Any substance that could dissolve the adhesive matter which agglutinates the folds of the roll, and not destroy the cohesion of the fibre of the papyrus, would effect this; and we possess, amid the vast array of chemical agencies and powers, what might surely accomplish this purpose: thus we might endeavour to unrol them in an atmosphere of steam: the vapour of boiling alcohol, or of ether, or that of naphtha; and chlorine and nitrous acid gas, might be tried. It would be necessary to unwind them in a soft state, and with great care. The method which is at present employed for unrolling these manuscripts was invented about the middle of the last century, by PADRE ANTONIO PIAGGIO. It is a most tedious process, and consists in supporting the roll on two hooks, and the edge of the papyrus, being attached to silk lines, is very carefully and slowly raised, by means of screws at the top of the frame, to which these silk threads are affixed. As the papyrus leaf unfolds, it is strengthened by apply-ing goldbeater's skin to the back of the leaf, by means of a weak solution of isinglass *(Colla di pesce)* laid on gently by a camel's hair-pencil: an inch or thereabout is the labour of an entire day. The Greek letters are exceedingly fine, and appeared to me much superior in distinctness and beauty to the Roman: the papyrus of the latter is of a thicker consistency, and more irregular than the former. As soon as a sufficient extent is unrolled, a fac simile of the manuscript is taken, and transferred to copper. I observed four volumes of these impressions. The vacuities are filled up by supposition, but such addenda are in *red*, and what is supplied can thus be readily discriminated. I noticed one particularly fine Greek manuscript in a frame; it seemed remarkably perfect, and was composed of forty columns, each column about eight inches long, and two and a half inches broad. The manuscripts already unfolded and deciphered are mostly composed of the writings of the wise men of Greece. Nine belong to EPICURUS, thirty-two to PHILODEMUS, three to DEMETRIUS, and some belong to CALOTES, POLYSTRATUS, and others. Immense numbers of these papyri seem to me irrecoverably lost, and all attempts to rescue them from oblivion, either by chemical or any other means, would be unavailing and fruitless.

The papyrus appears to have been known to HOMER, but it was perhaps then only one among numerous other materials used for writing upon. On the authority of VARRO, however, the invention was unknown in the time of ALEXANDER the Great, or about 400 years A. C. By the mention of it in Sacred History, already referred to, it appears to have been then well known; and, here at any rate, we have a period of antiquity, upwards of a century before the advent of CHRIST; and though Sacred History is silent on this subject, we may suppose that it was probably in requisition centuries before; for the passage quoted does not lead us to infer that it was a novelty. "The paper-reeds" is an expression which would rather imply a generality —an almost universal substitution—a subject that was familiar to every one. CASSIUS HEMINA, quoted by PLINY, mentions that one TERENTIUS on Mount Janiculum, discovered the books of NUMA, inscribed on Egytian paper, in a state of complete preservation, though buried in the earth for 350 years. ARISTOTLE mentions book-moths as well known, but this might equally refer to books written on the skins or intestines of animals. The Romans seem to have manufactured a vast variety of different kinds of paper from the papyrus, not far short of twenty. Some of these were used for writing letters, and plays, &c. Others were employed to wrap up goods in, &c. The *charta blanca* received its name, on account of its beautiful *whiteness*, which presupposes much labour in its preparation; hence we say a " blank sheet of paper," and hence too the French expression a " carte blanche."

Alexandria for a considerable period monopolized this manufacture; and by imposts laid on her paper, acquired a considerable revenue: this continued till toward the close of the fifth century. There are numerous manuscripts written on papyrus in the various libraries and museums of Europe, as in the Vatican, Ambrosian Library of Milan, that of Geneva, the Bibliotheque du Roi at Paris, &c., and in the Abbey of St Germain des Pres, was preserved a complete work on papyrus. In the Cottonian

Library there are four leaves, on which are written the gospels of St Matthew and St John. In Italy are numerous expositions of the Psalms, manuscripts of the Fathers, &c. on this species of paper. In the Treasury of St Mark at Venice, is the gospel of St Mark, said to be written by that Evangelist, some leaves of which appear to have been carried to Prague, by CHARLES IV. At Venice this curious relic, though completely illegible, and crumbling away under the slightest touch, is preserved with great care and veneration, in a gilt silver case made to resemble a book. At Vienna is a diploma of BENEDICT III., and a Latin document, both transcribed on papyrus. The record of ATTAKAR, king of Bohemia is on similiar paper, and in the library of St Gall in Switzerland, are the Homilies of ST AUGUSTINE, and ST ISIDORUS, written on the papyrus of Egypt in the seventh century, on thirty quarto leaves.

CHAPTER II.

PARCHMENT—PAPER—MANUFACTURE OF PAPER FROM LINEN AND COTTON RAGS—BLEACHING THE PAPER MATERIAL—SIZE FOR PAPER—MACHINE-MADE PAPER.

THERE can be no doubt whatever but that skins of animals were employed at a very early period as writing materials, and used by the Greeks as well as the Hebrews. When DAVID reigned over Israel, there existed among the Jews, books formed of such skins, and rolled up, called *Megilloth*, and such seems to have been the nature of the "roll" discovered in a coffer, *(Ecbatana)*, in the palace in the province of the Medes, which contained the record of Cyrus, concerning the temple of Jerusalem *, about 500 years A. C.

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* Ezra, vi. 2.

According to HERODOTUS sheep and goats' skins were in general use among the ancient Ionians about 440 years A. C.; and the terms *membrana ovilla*, *membrana caprina*, &c. used by various authors, are confirmatory of this opinion. In the sacred text, we read of "goats' skins dyed red, and badgers' skins." It should be observed here, that there seems no authority for the words *badgers' skins*. The Septuagint has it *hyacinthine* or violet skins, and it seems altogether referable to *colour* merely; a position which will be granted, we presume, without hesitation, when it is considered that the badger was included in the list of *unclean* animals, and it is by no means likely that the skin of an unclean animal would be employed as a covering for the sacred ornaments of the temple. The mention of goat skins in connection with colour, while the others are mentioned without the adjunct of colour, yields additional proof, and presupposes either an omission or mistranslation; besides the very same Hebrew word is elsewhere applied, (Ezekiel xvi. 10.), to denote colour in reference to shoes that might be worn on a wedding day. It does not seem to me improbable, therefore, that the Hebrew word may without violence be considered as intended to denote colour, and we know that the skins manufactured at Rome for writing, were sometimes coloured violet or purple; and there is at Zurich, part of the *codex vaticanus* written on *violet* coloured parchment; nor does it seem at all unlikely that these coloured skins, which were used as a covering for the sacred ornaments which belonged to the ritual and ceremonial worship of JEHOVAH, were inscribed with sacred symbols or writings, that the Jews, as they journeyed, might always have before their eyes a remembrance of JEHOVAH-JIREH, JEHOVAH-NISI, by whose providence they were led, and under whose shield was their security.

These inscriptions might be characters of gold, gleaming in the sun-beam, so that those in the most distant parts of the camp of Israel could direct their eyes from afar to the sacred spot which enshrined the Shekinah, or symbol of the Divine presence. It thus blazed as sacred fire from the point illuminated by the rays of the sun-beam, concentrated in all their glory on the golden inscription and blazonry of the richly coloured canopy. We know that the golden plate which formed a frontlet for the mitre of the High Priest, had this inscription "HOLINESS TO THE LORD,"—words which were also engraved on the very "bells," or *bridles* of the horses; and there is no reason to confine the sacred symbols to these. The fine copy of the Pentateuch, in the library of Trinity College, Cambridge, brought from Syria to this country by the late Dr CLAUDIUS BUCHANAN, and supposed to be 2000 years old, appears to me to be written on *goats' skins dyed red;* the character is very distinct and perfect, and *without points;* nor is there any division into sections. The ink appears to be composed of finely levigated charcoal, and to have been applied with a reed pen, the charcoal having been mixed up with gum or gelatine, most likely the latter. In the manuscript of the sacred text, the Jews were remarkably particular, and every possible care was taken to guard against error in the transcription. The skin or parchment was carefully prepared by them from the skins of *clean* animals, which were attached by strings of the same material. The Scribes were especially set apart for this purpose; thus EZRA and others. These manuscripts consisted of columns of equal length and breadth, and were composed of a similar number of words, without points. Nor was the evidence of memory relied on; they were orally and distinctly pronounced. The ink was of the purest kind. The name JEHOVAH was always inscribed with deep solemnity and attention, and the pen previously washed with pure water. When prosaic parts were written as verse, or any redundancy was accidentally introduced, it vitiated the entire copy. No illuminated copies were allowed to be introduced into the worship of the synagogue. The integrity and purity of the sacred text were thus amply insured and provided for; and it was almost impossible, under such extraordinary precautions, for error to find admission.

PTOLOMEUS SOTER, king of Egypt, having formed an extensive library at Alexandria, found a rival in EUMENES, king of Pergamus; and, in order to monopolize this acquisition, he prohibited the export of Egyptian paper. This interdict, under the son of PTOLOMY SOTER, called PTOLOMEUS PHILADELPHUS, seems to have led to the manufacture of parchment, as a substitute for that of which they were thus deprived. The Latin word for parchment is *pergamena*, from the original place of its manufacture, namely, Pergamus (now Pergamo), in lower Asia, and hence our word *parchment*. This manufacture may be dated at about 300 years A. C. Subsequently the Romans much improved the manufacture. In Pergamus the parchment had a yellow tinge, and was every way of an inferior description to that of Roman manufacture, where it was made delicately white, but was liable to spot; usually one side only was made white, while the other remained yellow; but, if intended to be written upon on both sides, it was coloured purple or violet; and the writing was composed of gold or silver characters, the former being only used for the sacred text, principally for the Psalms and Gospels. It does not appear that parchment came into use in Europe till the sixth century; nor was it generally employed until the eighth or ninth. Parchment, until 1280, was more generally employed in England and Germany than the Egyptian paper, made of papyrus. The papyri appear to have been of a specific size; but the parchment used was of various forms and sizes, occasionally as small as our playing cards. Ancient Roman missals give us very good specimens of parchment or vellum. I have a fine Missale romanum, somewhat yellow on one side of the leaves, but very white on the other: The yellow side is also smoother than the white, and altogether appears to have been differently prepared. On the invention of printing, parchment and vellum were used. There now exist many copies of the bible, in three folio volumes, printed on parchment in 1450. St Paul, in all probability, wrote on skins or parchments. Thus in his second letter to Timothy, he requests him to bring with him the books that he has left at Troas, particularly the skins or "parchments." The first were volumes already written, the latter were for transcription or epistolary correspondence,—τὰ βιβλὶα, μάλιστα τὰς μεμβράνας,—*the books, particularly the membranes.* Parchment should only be made, strictly speaking, of *calf skins*, in order to sustain the literality of the name, but other skins are used indiscriminately for the purpose.

There seems to be nothing certain or specific as to the period when our present paper-tissue was introduced. Paper made of cotton superseded the use of Egyptian paper, formed of the paper-reed; and this was again substituted by paper made of linen-rags. It does not appear that any paper was made of linen before the year 1307. The bulls of the Popes, SERGIUS II. JOHN XIII. and AGRAPATUS II. in the eighth and ninth centuries, were written on cotton paper. In all probability, the manufacture of paper from cotton was early known to the Persians and Chinese; and the Arabians may have obtained a knowledge of it from their conquests in Tartary. GUETARD, by beating cotton wool to a pulp, informs us that he was enabled to make paper of it; and the Moors, Arabs, and Turks make use of mortars and hand-mills for the purpose of reducing the cotton to the requisite consistency. Ancient paper does not possess any mark of the wires, by which, in the manufacture of modern paper, the water is suffered to drain off; we suppose the method employed by them must have been considerably different from that now used. We find a variety of papers described, under a diversity of names; thus *charta gossypina*, that made from the cotton of the gossypium, or cotton plant;

charta serica, from the cocoons, &c. of the silkworm. The Greeks probably used cotton paper sooner than the Romans. In ancient Rome, the paper prepared even from the papyrus, seems to have been sized and agglutinated as well as that of modern times. It was beaten with a hammer, and smoothed, and glued, and sized, as well as pressed. The glue employed in the process appears to have been composed of wheaten flour, mixed with boiling water, and a little vinegar; or else with crumbs of leavened bread, diluted with boiling water. The bread having been leavened, and undergone the acetous change, rendered superfluous the super-addition of vinegar. The most ancient manuscript on cotton-paper, is dated in 1050, and is in the Bibliotheque du Roi, at Paris. **Roger**, king of Sicily, mentions, in a diploma bearing date 1145, that he had renewed a charter on parchment, which had been previously written on *cotton*-paper. Its introduction cannot be traced farther back than the tenth century.

Chinese paper is made from various materials. The bark of the elm, mulberry, bamboo and cotton-tree *(Gossypium arborum)*; and occasionally from other materials, as hemp, rice, wheaten straw, and the scitamineæ, cocoons of the silk-worm, &c. Dr Morrison has translated into the Chinese language several parts of the Old and New Testaments, and had them printed on paper of Chinese manufacture. That substance which has been called *Rice Paper*, and becomes so fine a vehicle of colour, employed in ladies' ornamental and fancy work, there is every reason to believe, is formed of the medulla or pith of the *Arctocarpus incisifolia* or bread-fruit tree. Under the lens, in some uncoloured and more translucent specimens, a distinctly cellular structure may be easily perceived. I am possessed of a specimen of paper from the Loo-choo Islands, which is extremely beautiful, translucent, glossy, and shining on both surfaces, and is somewhat cellular in its contexture; but whether composed of highly compressed slices of the pith of some particular species of plant, or the inner membrane of the bark, it would be difficult to discover. It is not of an animal nature, and the former is not unlikely to be its proper source.

The Japanese make a fine paper from the paper mulberry, *Morus papyrifera*, called by them *Kaadsit;* it is from the bark of the young shoots of this tree, that they manufacture that fine glossy paper called *India Paper*. The shoots are boiled in water, which occasions them to shrink, and the bark is then separated from the wood. In order to convert it into paper, it is first cleansed of all impurities, and then boiled in an alkaline ley, being constantly stirred, till it becomes so tender that it easily separates into small fibres, on being touched. It is afterwards well-washed, diluted, and worked about, until it becomes of an uniform, soft, delicate, woolly substance, and is afterwards beaten with sticks till it resembles the pulp of soaked paper. It is then mixed intimately with the gelatinous mucilage of rice, and the *oreni* root, which renders the mixture fit for being formed into leaves of paper. In order to effect this purpose, they make use of moulds formed of bulrushes; and the subsequent operations are so similar to those employed by ourselves in the manufacture of paper, that detail becomes unnecessary. The paper is then dipped in alum-water, which serves instead of the size employed by us, and not only prevents the ink from blotting, but imparts to its surface an appearance as if well glazed or varnished over. It is in high estimation for the *proofs* of fine engravings, and adds exceedingly to the beauty of their appearance. I have specimens of India paper covered over with a complete efflorescence of sulphate of alumina, or alum. It has been supposed, that the superiority of India paper depends more on the fibrous nature of the pulp than on the mode of its manufacture. Thus it necessarily possesses a superior ductility, yielding to the pressure, and retaining more accurately and minutely the lineaments of the impression communicated to it. Its structure has much of that of a fibrous consistency, formed of silk. Two years ago, I discovered that the parenchymatous structure of the shoots of the white mulberry was a tissue of *white silk*, and have a specimen obtained from this source, which can scarcely be distinguished from China silk. We regret to learn that the cultivation of the silkworm has been abandoned at Kingston, in Ireland, and as the immense plantation of mulberries there, amounting to 30,000 trees, will thus become useless, it is a subject worthy of in quiry, how far a small admixture of the shoots of that tree would improve our present paper tissue.

There are several specimens of linen paper of the date of 1342, in the reign of EDWARD III. preserved in the Cottonian Library, and this period may be considered the earliest era of its introduction into England, although PRIDEAUX adverts to linen paper of 1320. It was introduced into France in 1314; and into Italy in 1367. A specimen of linen paper was sent to Mr MEERMAN from Germany, in 1763, bearing the date of 1308, which had the mark of the wire-mould, assumed to be characteristic of paper manufactured from linen rags. It was, however, glazed, and somewhat resembled parchment, which is the feature of cotton-paper; so that it has been supposed a mixed paper, composed of both cotton and linen. The water-mark of a *Bull's Head* has been imagined by the bibliomaniac to be incontestible evidence of the printing press of FAUST. The earliest water-mark adopted in the most ancient German paper manufactured from linen, and the first of this description, was used in the manufactured paper in Germany

1312. But the bull's head, being the armorials of Mecklenburgh, that country, on such a proof, would bear away the palm of priority, seeing that other countries might adopt a similar ensign.

ULMAN STROMER of Nuremberg wrote a work on paper-making in 1360, and, in the year 1390, established a large paper-mill. The first paper-mill erected in Great Britain was at Dartford, in Kent, by a person named SPIELMAN, a German, in 1588, in the reign of ELIZABETH. In France there are more than 500 paper-mills, consuming annually 20,000,000 pounds weight of rags, &c. The annual value of paper manufactured in Britain exceeds one and a half millions Sterling, the excise duty on which is about L. 150,000. A paper-maker at Venice has discovered a method of covering the surface of paper with a kind of varnish, the writing on which may at any time be wiped off with a sponge: this might be convenient for some purposes, but it is evident that damp would detach the film of varnish, and no permanent record could be obtained on such a species of paper.

In the manufacture of this valuable article, the rags intended to be converted into the form of paper are washed, and then assorted for the various kinds. They are then bleached, though the bleaching process is sometimes deferred to a more advanced stage of the process. The rags are ground in the washing-machine by cutters or knives, attached to a cylinder, which revolves with considerable rapidity: this coarse species of pulp, thus produced, is called by the paper manufacturer Half-Stuff, and in this stage of the process is the bleaching occasionally applied. This imperfect matter is afterwards transferred to the beating-engine, and, with water, is here converted into the state of a fine pulp, is then conveyed to the vat, and sustained at a specific temperature. From this vessel it is taken up by a fine wire-sieve or mould of hair-cloth, from which the water drains off, and where the pulp speedily coagulates into a sheet of paper: the water-mark is communicated by the wire-cloth, which is woven in that form, and thus yields its impress. The removal of the sheet of paper from the wire-mould is called *couching*: these individual sheets are superimposed, the one over the other, with a sheet of felt between each, and the remaining water squeezed out by powerful pressure; the felts are subsequently removed, and the sheets again pressed by themselves, are at last dried in the drying loft. In the case of printing papers, they are *sized* by the ingredients being added to the pulp in the engine, but writing papers are generally dipped into the size, and again pressed and dried; for it should be observed, that all papers, until they undergo the process of sizing, are in the state of bibulous, or blotting, or filtering paper, and the ink would run on such a surface. The papers are finally picked and assorted, the knots or rough parts removed, and blemished sheets rejected; and after the examination, which each sheet undergoes, the whole are subjected to immense pressure, to obtain an even and smooth surface. After this is finished, the paper is made up into quires and reams for the market. Such is the simple process of the manufacture of this valuable material, which is one of the most staple pillars of civilization.

The process of sorting the rags cannot be too particularly attended to: linen ought to be carefully separated from cotton; *white* linen or cotton rags ought again to be parted from those that are *coloured*, because a feeble bleaching-power would serve the former, while the latter, requiring a stronger bleaching power, yields a less cohesive material for paper; the bleaching-agent in the same ratio deteriorating the fibrous structure of the rag. Beside, the bleaching-gas discharges *blue* with greater facility than other colours: therefore such colours should be separated, and also the coarse linen and cotton rags from the fine. New rags, or those almost new, should be also detached from those that are old; and, perhaps, seams should be laid aside in the finer descriptions of paper. The grand object must be the attainment of a pulp of *uniform consistency*, for on this the beauty of the paper materially depends, and it is easy to ascertain the point, by holding the sheet of paper up between the eye and the light; these should all be milled, or cut and beaten separately, because they will require different periods of manipulation. The pulp to make a genuine paper should be of a fibrous consistency; for, devoid of that structure, it can possess no cohesion whatever. One serious evil resulting from the bleaching of the rags, is the destruction, or partial decomposition, of the fibrous part, by which the paper tissue is rendered completely tender and friable; and another mischief consists in the advantage which it gives to the manufacturer to use coloured and uncoloured rags indiscriminately, or a mixture of both. Sometimes the rags are bleached after having been washed, and at other times in the state of half-stuff; for the first of these processes a patent was taken out in 1792, when our paper began to be deteriorated,—an unfortunate era for our literature. But after the paper is completely manufactured, it has also been exposed to the action of the bleaching-gas, or as it has been *technically* called, "fumigated," —a process still more injurious.

Deteriorated though the rag be in its fibrous structure, by the destroying influence of the gas employed, and still more by the indiscriminate use of cotton and linen rags, the pulp is mixed up with alabaster or gypsum, which is made up in a separate vessel, and finally added to the pulp, in many instances, it is said, to the amount of 25 per cent.; and, from specimens I have examined, I have reason to think that both pipe-clay and sulphate of baryta have also been occasionally employed. Such additions are most fraudulent, and exceedingly reprehensible, and sap the very foundation of a good paper material. The ingredients employed in the composition of the size form another cause of deterioration. *Alum* is the chief source of the injury which the paper here sustains; and the mischief is twofold. Suppose *chloride of lime* be employed in bleaching the rags as half-stuff, the excess of acid in the alum, it being a bi-sulphate of alumina, decomposes a portion of the chloride of lime, which attaches to the integrant particle of the pulp, and, by forming a sulphate of lime, liberates, at any rate, a portion of the chlorine, which acts on the paper and destroys it; or it is converted, by the contact of moisture, into muriatic acid, which brings, in virtue of the aqueous medium, the destructive acid in more immediate contact with the paper, and its decomposition is thus more speedily and efficiently accomplished. Should there be a small residuum of chloride of lime still combined with the paper material, it is soon, by the contact of damp air, converted into the muriate or hydro-chloride of lime, a most *deli-*

quescent salt, which, by abstracting moisture from the atmosphere, causes the paper to become damp, which in consequence spots, and soon rots away. Such are the fatal consequences of bleaching, either with chlorine simply, or chloride of lime in conjunction with alum employed in the size.

The mould on which the pulp is taken up from the vat was formerly, and in some instances is still, composed of parallel wires, with interstices or spaces between, about the thickness of the wires. Transverse wires, about an inch apart, strengthens the texture, and toward the centre of either side of the leaf of each sheet is found what is called the *water-mark*, communicated also by wires woven in that form. Thus, the crown, or other device, initials, or full name of the manufacturer, date, &c.; and, in the case of bank-note paper, the water-mark expresses the name of the bank and value of the note, as in the case of Bank of England notes. Paper thus made is called Laid Paper or Wire Paper. The greater part, however, of modern paper is made on wire woven in the manner of cloth, of a close texture, and such is called *wove* paper, because made on a mould of close woven wire. This is, in point of durability, far inferior to wire or laid paper, because, from the closeness of the wire-cloth and its fineness, the pulp may be used of a much more attenuated and less fibrous consistency, and its cohesive strength is in the same ratio diminished; and if it be torn asunder, it does not discover the same fibrous and rough or hairy edge as laid paper. It is obvious, however, that the water-mark may be still communicated. This smooth surface or vellum paper, whether made by the hand or machine, for printing on, has sometimes communicated to it, by means of fluted rollers, a ribbed appearance, which certainly looks very beautiful, and, we think, displays typography to much advantage. Powder blue or smalt, is added, either to the pulp or to the size, in order to impart a *bloom* to the paper, and some fine specimens of pumice-like blue spongy masses are obtained after the combustion of Bank of England Note-paper, in consequence of the concentration of the smalt employed in the manufacture of the paper. A fine specimen of this kind may be seen in the British Museum, whereon the expressed value of one of the notes is still preserved. It is by the addition of various colours in this way that the French, and we in imitation of them, produce vellum paper of all the tints of the rainbow. In other cases, however, the paper is stained in a different way. Printing papers do not require to be so completely sized as writing papers; and the size is communicated to the engine in which the pulp is beaten by adding alkali and oil, or an *imperfect soap.*

Formerly, in the case of tub-sizing, when each sheet was separately dipped into the size, it was composed of gelatinous matter, obtained from the shavings of hides, cuttings of skins, and other animal materials; but, unfortunately for the typographer, who wishes to excel in his beautiful art, and present the public with finished specimens of his excellence, the paper manufacturer, by an injudicious introduction of improper substances, wages an indiscreet war against him, and the difficulties he has thus to contend against are of the most formidable kind. Printer's ink may be stated to be finely levigated charcoal ground up with oil. But as the carbonaceous matter is not alike pure from all sources, a selection must be considered necessary; and, while lamp black was considered good enough in former years; in this age of advance and improvement, other sources have been consulted, as the carbonaceous matter of decomposed alcohol and coal-gas. We should recommend pure resin as perhaps supplying a still purer carbon; and carbonated hydrogen will yield a carbon different in its properties, according to the sources of production and obtainment: thus, that from oil will be superior to that of the gas from coal, and the carbon of olefiant-gas superior to either; and as *raven-black* is now the fashion of the day, indigo or Prussian blue, we believe, has been added, but the latter cannot be considered permanent, when brought to the test of time: and the former, being a vegetable production, can scarcely be considered otherwise than fugitive after a lapse of years. The purity of the oil must not be lost sight of; it must needs be of a *drying* kind, as linseed or nut oil, which ought to be purified highly, and the older the better; it must also be boiled previous to the mixture of the carbonaceous matter; and litharge and spirit of turpentine must be added to the oil if new. It is obvious that, from the addition of alkaline ley to the pulp in the beating-engine, the ink must undergo a decomposition in the act of printing, for the oil employed as a vehicle will be attacked by the alkali in the paper; or, if the mixture of ley and oil should have combined to form a saponaceous compound, it would be found extremely difficult to communicate a clear and distinct impress by types and printing ink to such a surface as this. Moreover, in the event of gypsum having been employed and mixed up with the pulp, a partial decomposition of this sulphate of lime would result, by the superior affinity of the alkali; and, in the event of writing ink being applied to paper with free alkali in its constitution, a partial decomposition of the ink would certainly ensue. Now, if alkali and oil are to be added at all to the paper material, it must be in the state of an already formed soap, accurately tested for the presence of free alkali. These observations readily explain the just complaint of the printer, that the ink will not *set*. No soap whatever ought to be employed in the fabrication of printing papers; nothing can be better than a mixture of glue and fecula or starch, obtained from farinaceous seeds or roots, as the oat, barley, potato, &c. or in the state in which it is called by the calico-printer, British Gum. Whether or not wheaten-flour, in consequence of the *gluten* it contains, might be found an improvement, I have no means of determining. The only remaining principle that might be here suggested, would be a trial of animal *albumen*, as that of the whites of eggs, or serum of blood; at any rate, saponaceous materials ought to be discarded. If the paper is what it ought to be—a well agglutinated fibrous material, free in its contexture from the elements of decomposition and deliquescent substances — the typographic art holds out a source of the most permanent description, as the charcoal, of which the printing ink is composed, is in its nature, chemically speaking, incapable of change, and indestructible; not even fire, in its fiercest form, has any power over it, if other chemical principles, as oxygen, &c. be absent; these letters, constructed of charcoal, being stamped in by the type and press, are further sources of security. Ample evidence of this kind is supplied to us in the case of ancient papyri; and I possess a specimen of papyrus, from a mummy case, bearing both the hieroglyphic symbols and enchorial character, in which the letters are of the most beautiful jet-black.

A machine to supplant manual labour has been very generally introduced into paper manufacture: though we more than doubt that it is an *improvement*, the process is exceedingly accelerated, and that effected at one operation which formerly required several distinct manipulations. We believe France was the cradle of this invention, but the machine, at first rude, has been much improved by Mr DONKIN and others, and modifications of the machine have also been invented. Those of Messrs FOURDRINIER have been generally established in Great Britain. The machine is rather of a complicated structure, but may be said to be composed of finely woven wire-cloth, of several yards in length, extended horizontally between rollers, so as to represent a table, which is maintained in constant motion by the revolution of the rollers: the pulp, in a continued stream, is made to flow and diffuse over the wire-cloth surface, and is carried forward by the movement of the machinery, while a lateral impulse is communicated, by other mechanism, in order to *compose* or consolidate the pulp equally on the wire-cloth. This paper-coagulum is taken off at the further extremity of the wire-cloth, and subsequently passed between rollers, as in the flatting-mill. Those who have seen cotton-mills can form a tolerable idea of this paper-making machine; many of the principles of the movements in the machinery of the former being employed in the latter; and it must be at once apparent, that while, in the hand-made process of paper-making, the size of the sheets was of limited dimensions, no such obstacles can occur here, and consequently, the sheet may be made of *almost any extent.* The machine is by no means limited to the manufacture of wove paper, according to the original intention and design, but is also used to make laid paper, in wire moulds, as formerly effected by manual operation: these separate moulds are wrought by machinery, and the process, in all its parts, accomplished without the intervention of manual labour. About twenty-five years ago these machines were introduced, and they form another era in the deterioration of the paper manufacture; for by means of them an immense quantity of inferior paper was thrown into the market. The machine required, at least in its original construction, that the pulp should be ground to the finest possible consistency, and being necessarily void of fibrous matter, its cohesive strength was thereby reduced. Before the more rapid and deteriorating methods of modern times, the sheet of paper, after having been duly dried in the drying-loft, was dipt into a size, formed of gelatinous matter or glue, and this imparted additional cohesive consistency to the paper; whereas, in the case of the machine-made paper, a large quantity of alum-water is mixed up at once with the pulp in the beating engine. While the paper made in the machine is principally *composed* by pressure, the hand-made paper possesses the advantage of being more equally formed and settled, in being duly shaken and tapped by the hand. The hand-made paper being manipulated in warm water, and the pulp in the vat preserved of the required temperature, thus acquires a facility of being more easily formed and settled: an equability of diffusion and consistency will thus be acquired, of which the machine-paper must in a great measure be deprived, for it would be a matter of some difficulty, to impart and sustain an equilibrium of temperature to the pulp flowing on the wire-cloth of the machine. In hand-made paper, too, pulp of a more fibrous consistency may be worked than can be done by the machine.

CHAPTER III.

SUMMARY OF EVILS IN PAPER MAKING, AND SUGGESTED REMEDIES—VARIOUS SUBSTANCES SUBSTITUTED FOR LINEN AND COTTON RAGS IN THE PAPER PULP—BANK OF ENGLAND ENQUIRY FOR THE PREVENTION OF FORGERIES—CONTINGENT EFFECTS OF BLEACHED PAPER—MODERN PARCHMENT AND VELLUM—WRITING INK.

THE various sources of decomposition and decay in modern paper, we have already detailed in the preceding pages, in describing the manipulation of paper-making, and have also given testimony in favour of hand-made paper, over that manufactured by machinery. In process of time the latter may certainly, in this inventive and ingenious age, receive improvements that may obviate all objections, and the vast quantity of work done by the machine, compared with that effected by manual labour, will raise its value in the estimation of the paper-makers, as one machine will throw off as much paper as fifteen men can make in a similar period. I should be sorry that any opinion of mine should be construed into a sentiment hostile to the diffusion of mechanical aids: it is only by such ingenious applications of mental prowess that we can compete with the progressive demand which our literature claims from us. It is by the ingenuity of our mechanical arts, conjoined with our local advantages of insular situation, and our canals, and our coal-mines, that we can withstand our continental neighbours, and compete for the prize of superiority. We would, therefore, suffer mind to bring its full stores to the contest, and avail ourselves of its wonderful and varied resources. On the Continent of Europe, manual labour is of much cheaper obtainment than with us, and a substitute must therefore be found in British genius, lest we be worsted in the struggle.

The *second* source of evil must be sought for in the mechanical consistency of the pulp. Let it never be forgotten, that a fibrous structure is essential to a lasting paper-material, and the fibre of linen rags is in every respect stouter and more durable than that of cotton, while the introduction of earthy substances will ill compensate for such a want; but should the cohesive and fibrous texture of the vegetable, whether linen or cotton, be reduced by any means whatever to a mere jelly, it is a matter of no consequence what be the source of the paper-pulp: our paper may as well be tablets of plaster or stucco, as any thing else; but damp will speedily cause decay, and, like quicklime, when water is poured upon it, it will crumble to atoms. The simple fact, that hair, or any fibrous substance mixed up with lime, imparts cohesive properties to it, affords a proof of the folly and ruinous consequences of wove paper, while at the same time it imparts a useful hint for its improvement. We have made a great many experiments on the comparative cohesive strength of the parenchymatous fibre of a variety of trees and shrubs, &c., as those of the *mulberry*, *birch*, *willow*, *bramble*, *hemp*, *flax*, *nettle*, *Phormium tenax*, *&c.*, and are inclined to prefer *unbleached flax*, *bramble* and *nettle*, all of which would very much increase the strength and durability of paper. The New Zealand flax or *Phormium tenax*, is too rare for such a purpose. The birch, willow, bramble, and nettle, will be found, if we mistake not, powerful and valuable auxiliaries to the paper manufacturer, as the supply of several of the others might not be as available, or in sufficient quantity, or so economically subservient; but a *small proportion* of unbleached flax added to the half-stuff, would most materially improve the cohesive strength of the paper tissue, provided the beating process were not carried to its maximum,—the great source of injury. These materials should also have animal fibrous substances, as shavings of pelt or skins, added, and such addenda would, we are certain, improve the texture and consistency of the paper produced from it.

A *third* source of evil consists in the adventitious mixture of earthy substances in the pulp: even snow must be cast into shade by the exterior whiteness of modern paper, and if the bleaching gas, or its association with lime, will not produce the effect, *gypsum* must needs be added to accomplish the end, as well as to impart weight and consistency. Display is the order of the day, for show all else must be sacrificed, and for the exhibition of an hour, permanence and durability must be abandoned. No earthy matter whatever should be suffered to enter into the composition of the pulp,—every species of terrene material is equally deleterious and mischievous; brittleness and want of cohesion and consistency, are their invariable accompaniments.

A *fourth* cause of the disintegration and decay of paper is to be found in the *alum* which is used in the size. In the case of printing and machine papers, it is added at once to the pulp in the beating engine, but formerly, and occasionally even yet, a certain number of sheets are dipt by the workman into the sizing tub, containing diluted gelatine or glue, formed from shavings and cuttings of pelt or skins, to which a certain quantity of *alum* has been added. Now, as has been already premised, alum being a *bisulphate*, or, in popular language, containing a proportional excess of acid, the chloride of lime employed to bleach the half-stuff, or the already formed pulp, is decomposed by this means, and the free hydrochloric acid (muriatic acid) let loose to corrode the paper-tissue, or free chlorine is evolved to form the same mischievous acid, and effect the same process of destruction. Now, chlorine, when *perfectly dry*, seems inert in its discharge of colour, or in the process of decomposition, but, by a hygrometric change in the atmosphere introducing humidity, damp imparts to it the power to destroy the surface it is in contact with. Besides, the portion of muriate of lime that would be formed on the contact of damp air, from the chloride of lime remaining united with the paper material, would always, from the highly *deliquescent* character of that salt, impart to such paper the susceptibility of, and tendency to, absorb moisture, and to contract damp. We should therefore recommend the substitution of the *acetate of alumina* for the alum, as is employed in the process of calico printing; and in the case of a neutral salt, such a decomposition as that we have adverted to would not occur, and one evil at any rate would be completely prevented. In several specimens of India paper, the size used seems to be merely that of alum, which is proved in the efflorescent incrustation already referred to.

The *fifth* and chief source of the disintegration and ruin of modern paper, is the process of bleaching, in whatever stage it may be applied, or in whatever form it may be used, whether as chloride of lime or gas. This destructive agent is too generally clumsily, or incautiously, and unwarily employed: I have specimens of paper, where the sheets have evidently been "fumigated" after being completely fabricated; and the chlorine gas is in a state of such loose combination, that, as soon as it is slightly heated on a metallic plate, the gas is disengaged almost to suffocation, and evolves white clouds on the approach of a feather dipped into ammonia. The gas ought not to be employed otherwise than to bleach the rags after being shred by the cutters. Great care should be taken to have the chlorine much attenuated in its bleaching strength, by dilution with water; and the rags should be thoroughly washed afterwards. Indeed frequent affusions of water will be found necessary to steer completely clear of all danger. We can on no account whatever approve of *chloride of lime* as a bleaching power; but we see much less danger in employing *chloride of soda*, because, in such a case, were bisulphate of alumina to be used in the size, and a small portion of the chloride of soda remain in combination, a decomposition, by the excess of acid in the alum, of the chloride of soda, would form a sulphate of soda which, so far from constituting a salt of a deliquescent kind, would give rise to one of an *efflorescent* character, and repel and give off moisture rather than absorb it; and, if the chloride of soda were otherwise formed into a muriate, a pure muriate of soda would have no tendency to attract moisture; for, when rock-salt weeps in damp weather, and common salt becomes moist, they do so, in all probability, from being associated with *muriate of magnesia*, an ingredient in brine springs, and salt water.

Among the best specimens of modern paper which I have examined, are the patent bank-note paper of Messrs ROBERTS and CRAWFORD, and of Messrs WISE and BRENCHLEY. As I have not had an opportunity of examining their specifications, I am of course unable to state their ingredients or mode of manipulation; but I have stated the chemical principles on which a durable and good paper can alone be manufactured; and it is hoped that the conditions will be duly weighed by the manufacturer. Our modern books and manuscripts are in a state of the most rapid decay. The greater part of them will not outlive half a century; many of them not half that period. An ichorous matter, more rapid far than the tooth of Time, is hurrying them onwards to the land of shadows, and the "tomb of all the Capulets." We have had in possession letters that have become a *carte blanche* in the course of a few years; and others, already perfectly illegible, have been shewn to us. A French gentleman submitted to me a letter, of the date of the 18th March 1815, written on *papier velin*, which was in a state of complete integrity, though almost constantly exposed to friction in the pocket; and another on *English* paper, in a most ruinous condition, and crumbling away, though preserved with the greatest care, being one from a departed friend. The latter was distinctly aluminous to the taste. By chemical reagents I cannot detect alum and chloride of lime in the case of any French papers I have tested, otherwise than in such minor quantities that the causes of deterioration and decay are in a very diminished ratio indeed, compared with paper of British manufacture. For instance, "Le Nouveau Testament," &c. edition stéréotype, publiée par les soins de M. Frederic Leo, &c. à Paris, 1816. I have singled out this date, by way of contrast with the Bibles issued by the British and Foreign Bible Society of that year. The former is the typography of M. Firman Didot, of Paris; the latter that of the Oxford University press. I may also, in farther proof of the superiority of French printing papers, refer to that noble work, "Dictionnaire de l'Académie Française, 4to, 2 tomes, à Paris, 1814, cinquième edition." The paper is also that called laid. The vignette above, includes the words "à l'Immortalité;" and, though this expression is what may be called truly *French*, it would be mockery in us to bring our tomes into competition as to their respective duration. I do not see why we should be so far behind hand with our Gallic neighbours, or why we should either invite the scorn and execration of our posterity, or lose the record of all we account dear and valuable. We have been informed, how far true we cannot tell, that the records of the House of Commons bear traces of decomposition in the paper or the ink. A gentleman of M—— informed me that some of the accounts of his leger could not now be decyphered. A mixture of modern printed and old books remaining in a chest, and exposed accidentally to damp, discovered the latter little if at all injured, while the former were in a state of great decay. A friend of C—— was induced, in consequence of what I had stated on the subject, to examine a great many valuable manuscript deeds that had reposed in an iron chest in his possession; and he personally informed me, that, while the modern ones were, in many instances, illegible, and some almost completely destroyed, in both paper and ink, the older documents still remained in a state of complete and unexpected integrity. In one case, the writing was completely expunged. In the instance of a letter from Essex, sent to an individual at Sheffield, an inclosed bank-bill was half way out of the letter when it reached his hands; and an eminent paper manufacturer in England mentioned a similar occurrence which happened to himself, in a letter sent from Manchester. He added, however, that it was *not* paper of his *manufacture;* and I am bound to believe the assertion. We have had and seen specimens of paper, that, being folded up, crack at the edges, and fall asunder; and, in others, on being slightly heated at the fire, similar ruin follows. Sometimes, too, the paper is so brittle that, on being bent, it snaps like a watch-spring. One letter forwarded by post fell to pieces by the way.

The ink in printed books and manuscripts soon betrays the fatal secret; and, from previous remarks, the cause is but too evident. Old books are, by a proper emphasis, termed BLACK letter books; and we have no occasion, for our illustration, to go so far back as a CAXTON or a WYNKYN DE WORDE for the proof. The mischief, which has been ever since gaining ground, has originated within these forty years,—when Mr CAMPBELL obtained his patent for bleaching the rags by chlorine gas in 1792. Our modern volumes are *brown* letter books. Among other sad memorials of decay among my books, I possess a royal octavo copy of the Bible, printed at the

University Press at Oxford, in 1816, CRUMBLING LITERALLY INTO DUST, and which was in this state, in parts, before ever the volume was used. Almost the entire book of Genesis has mouldered away, and left not a trace behind. I have submitted the leaves of this copy of the Bible to a rigid chemical scrutiny. To the tongue it presents a highly aluminous and astringent taste; and, on a heated metallic disc, evolves volatile acid matter, exhibiting white vapours on the approach of ammonia. The paper is as friable as tinder, and of a somewhat yellowish or dingy white hue; the ink is brown. The leaves were macerated in water, and the solution passed through bibulous paper. *Litmus* paper was reddened. *Hydriodate* of *potassa* became greenish-yellow, from free sulphuric acid arising from the excess of acid in the alum. *Oxalate of ammonia* gave the usual indications of *lime*. *Nitrate of silver* detected the presence of muriatic acid arising from the *chlorine* employed in bleaching the rags, half-stuff, or paper; and *nitrate of baryta* proved the presence of a *sulphate*. The inferences from these tests are *alum*, *gypsum*, and *muriatic acid*, —conclusions warranted by *a priori* remarks.

The result of this investigation, I communicated to the British and Foreign Bible Society; and the following is a copy of a reply of the Committee, through their Secretary, dated 10th November 1823.—" SIR,—A continued pressure of business has hitherto prevented me communicating to you, according to my instructions, the thanks of the Committee of the British and Foreign Bible Society, for your letter addressed to the Right Honourable Lord TEIGNMOUTH, their president, upon the subject of the paper used in 1816, for the Bibles printed for this Society; and I am also directed to inform you, that since that period, the Committee have adopted unbleached paper for their Bibles and Testaments, and have made arrangements accordingly with the three authorized presses for printing English Bibles and Testaments. I remain, Sir, respectfully," &c.

Now, this is by no means a solitary case, or peculiar example. Some of the most expensive works of modern times contain within themselves the seeds of destruction and the elements of decay. They need no book-moth to accelerate their doom, while FUIT may be, at no distant period, inscribed upon their *husks.* So charged are some descriptions of paper with gypsum, and other earthy matters, as to be nearly *uninflammable*; so that such a *desideratum* might be effected, though at too costly a purchase; and some books are so saturated with chlorine, as to be almost *anticontagious*; but this preservative need not be purchased at the expence of our libraries, when it can be had for a few pence. Mr HANSARD makes the following remarks on this important subject:—"Whole piles of quired stock are already crumbling to dust in the warehouses of booksellers, never to come to light as books: and many a volume, designed to enrich the library of its possessor, and to descend as an heir-loom to posterity, now presents to the mortified owner, its elegant print, surrounded by a margin of tan-colour, which, in some instances, forms as it were a complete frame round each page; the oil-varnish, in the composition of the ink, seeming to preserve the interstices between the print from the same kind of discoloration. School-books, printed on this species of paper, will scarcely last out their destined period from one vacation to the next," &c. *

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* Typographia, Lond. 1825, p. 231.

A great variety of substances have been used as materials for the paper pulp, to substitute linen and cotton rags. Even cordage has been attempted to be made, as well as paper, from the stems of the hollyhock, but it was found not to answer. Mr MADDOCK of Cork, manufactures paper from straw, new hay, fir-wood, and potato-stalks; and the title-page of COBBETT'S Treatise on Indian Corn, he tells us, is printed on paper made from its husks and leaves. I possess a volume, printed in 1800, on paper manufactured from *straw;* and the appendix is printed on paper made from shavings of wood and saw-dust. A large manufactory was established some years ago for the conversion of straw into paper, but it did not succeed; and, in 1802, a Mr KOOP took out a patent for straw paper. The straw or hay, by the action of *quicklime* and alkali seems to have been reduced to utter worthlessness as a paper material; and, as if this were not enough, the patentee suffered the mass to ferment, in order to complete the process of decomposition, and destroy the fibre *in toto!* These strange operations were also applicable to thistles; and indeed we do not know any vegetable substance whatever, that might not be, with equal propriety, used for paper-making, if these extraordinary processes are admitted as legitimate preliminaries for the manufacture of paper. I possess the following specimens of paper; and these will shew the variety of sources from whence paper has been obtained:

Paper of leather.
—— woollen.
—— linen.
—— cotton.
—— silk.
—— straw.

Paper of new hay.
—— willow.
—— woodshavings and saw-dust.
—— unbleached flax.

Paper made from the Paper Mulberry, (*Morus papyrifera.*)
—— —— Amianthus (incombustible.)
Rice Paper, Loo-choo Paper, Papyrus, Vellum, Palm-leaves, &c. &c.

To these it may be also added, that paper has been made from *old waste paper* remanufactured! Also from fir-wood, potato-stalks, holyhock, Indian corn leaves, thistles, liquorice-plant, and doubtless various other materials of which we have not heard; but what has been stated is enough to prove that linen and cotton rags are not the exclusive sources from whence the paper material has been derived.

Some years ago, the Bank of England instituted a very important inquiry on the question of the prevention of forgeries; and, while we shudder at the multitude of victims which that establishment claimed as her trophies, we must give the association all due praise for the readiness she shewed, though tardy, to listen to the various suggestions and plans of scientific and ingenious men. Happily, since the abolition of one-pound notes, this crime, with respect to Bank of England notes, has become exceedingly rare; and, though the public did not give the Bank of England much credit for her exertions, we believe that this very investigation cost the Bank upwards of L. 24,000, and we have this on the best authority, namely, from one of the Commissioners engaged in the inquiry. Multifarious and truly ingenious were many of the devices submitted to the inspection of the members; and a great many of these very curious and singular specimens were presented to me. The projects were numerous and diversified. The paper, water-mark, devices, and ornaments, all displayed talent and ingenuity. The best paper submitted, as far as I could judge, was that of *unbleached flax.* It is indeed a stout and tough material; and, in the specimen I have, the paper is semi-transparent, and seemed to be among the most tangible methods submitted. Some of the paper, when held up between the eye and the light, discovered a copy of the bank-note, either in white letters on a red ground, or black letters on a similar ground, or a combination of both,—a device by machinery, which, every time the points fell on the copper-plate, described a new form or figure, the changes being innumerable; but many of these specimens being assigned to one of the Bank engravers, were returned with *fac similes* so perfect, that the ingenious authors of the devices could not discriminate their own originals; and some of them actually took away with them the *fac similes* by mistake, for what they believed to be their peculiar creation: and it is quite astonishing to observe, in one specimen, what a remarkable approximation is made to the curves and figures, resulting from mechanism, by the mere manual dexterity of the engraver.

Sir WILLIAM CONGREVE'S patent triple paper was duly estimated, and has been, in some cases, adopted for English provincial notes, though we cannot at all give to it our honest recommendation, because we have seen a local note separated into three distinct films, one of these severing the Government stamp completely from its frontispiece. PERKINS and HEATH'S steel-plate, with its elegant curves and whirls, though ingenious and beautiful, was of necessity abandoned. I have a specimen of wood-cut letters, which had their place also in the inquiry, excelling even the most beautiful copperplate. One of the most singular suggestions connected with this interesting investigation, was that of the impress of a *duck's foot*, which it was contended was subject to interminable variation. In the whole course of this curious and important question, the most tangible and efficient plan, and that most likely to succeed, was a proposition to combine in one the most finished specimens of copperplate and wood engraving, and of typography, and from this combination of the most beautiful gems of the first artists and typefounders, to *stereotype* the specimen by a cast in stucco communicated to a metallic alloy.

Such was the plausible and ingenious plan suggested by Messrs Applegarth and Couper, and they had even invented a metallic composition, which would not change or shrink by alternations of temperature; but, with all these circumstances, and the aid of their steam printing engine, these ingenious individuals could not engage to supply perfect *fac similes* to the full amount of the desiderata of the bank, which we believe required not less than a daily supply of 80,000, and, on occasion of the payment of the dividends, to about 120,000. The very simplicity of their note-engraving, while it might give facilities to the commission of forgery, also affords the means of securing *fac similes* of their notes, and renders therefore more facile the method of detection. We understand that four engravers are at constant work; four new plates are *daily* presented, and after the required supply is struck off, the plates are cast aside; and it is certainly extraordinary that such an exact similitude should be maintained from day to day by four different artists. In a more complex and finished engraving, it would be impossible to maintain this integrity and identity, and supply the vast quantity necessary to meet the demand of this unweildy and mighty association, rendered still more difficult by the senseless daily waste and destruction of their own notes, as they are in no case reissued. Even the new note that is issued for the first time, if taken back for exchange for smaller notes, within an hour, is destroyed before your eyes with all due pomp and form; this we have witnessed.

The universal rage that prevails amongst us for bleaching every thing, gives rise to consequences occasionally amusing indeed, but also sometimes hurtful. Were it merely ludicrous, laughter, or contempt and scorn, might be the excited feeling, but evils of a serious and destructive kind are too often accompaniments. Displays in snowy vesture are everywhere obtruded. The isinglass, that must soon melt away in jellies, must needs be blanched, though colouring matter be required to dye it subsequently; and ginger, too, must be bleached, though at the expence of its aroma. Starch, in like manner, though it may afterwards spoil the colour of the linen, must *ad interim* be duly whitened by chlorine, according to HALL'S patent, though Prussian blue be added afterwards. Our daily bread, though not yet subjected to the bleaching virtues of chlorine gas, is nevertheless blanched at the expence of health, and *often of life*, by the superaddition of styptic alum, and its constipative effects—one of the most injurious and deadly sources of the varied "ills that flesh is heir to." Though we are satisfied, from the experience we glean in our domestic economy, that mere flour, water and yeast, with all our care, cannot make bread half so white as the snowy produce of the public baker, yet we persist in our folly, with conviction flashing on the mind. Though it might be somewhat unpleasant to inhale repeated doses of chlorine gas during meals, it would be the least evil of the two. We were told by a druggist in a town in England, that he supplied one baker alone with *several cwts.* of alum annually. Indeed the organ of present taste and fashion is somewhat eccentric in its evolutions. Paper and articles of food are blanched, and colours kept for silks and ribbons; or reserved for sugar plums and gilded gingerbread for *children*, forgetting all the time that the colours employed to paint the former, comprise some of the most virulent poisons that chemical means can furnish, and that the latter *gilded* bait is a sad misnomer, this apparent gold being merely *copper* foil. In these interesting matters, too, we are sufficiently scrupulous in our economy; and the confectioner must needs supply us with an article for which, were it *genuine*, we should give nearly double, whereas we pay only about two-thirds the value of the original cost of the material; we are therefore necessitated, as a proper price set on our miscalculating economy, to devour one-half the mass in *pipe-clay and stucco;* not that there may be any thing very prejudicial to health in either of these; but we are happily not in the condition of the South American clay-eaters, whom we are informed by M. DE HUMBOLDT are constrained to eat this earth for want of better food. Candles, and many other articles, are also bleached with chlorine*.

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* In France they are, in one respect, a step in advance of us. Loaf-sugar is made to receive a *slight blue tint*, by the ad-

The sad effects of bleached paper do not tell merely in manuscript and printing, but extend to the several circumstances in which white paper is employed. Thus the delicate flowers in a *hortus siccus*, with leaves of whitened paper, have all the colours discharged—a case which we know has actually occurred. Blue litmus paper must not be folded up in this description of cover, and we have found ourselves not a little embarrassed in the use of unsized paper thus blanched in our filtrations; the tinctures have been changed, and chemical solutions been decomposed. *Gilt buttons*, to the amount of some hundred pounds, have been lost to the manufacturer from being folded up in bleached paper, chlorine having the power of dissolving gold; and the loss to the paper-stainer and colourer by the use of such paper, might be an evil of the most serious magnitude; and destructive to his trade. The delicate colours of silks, by being folded in such paper, are effectually discharged, and *violet*, *peach*, *lilac*, *lavender* and *mazarine*, are almost immediately acted upon:

dition of *smalt*, as in paper; and smalt contains, or may contain, *arsenic*.

these are truths of actual occurrence, and were communicated to me by a manufacturer of Macclesfield. Chests of drawers, and boxes, and cases, are often lined with snow-*white paper;* but if gold or silver plate, &c. or coloured silks and satins, be suffered to remain in them, corrosion, tarnish, and discharge of colour, must be the inevitable consequence; and as new flannel, and straw, and white silk, are bleached by the vapours of sulphur, contact with them must also be carefully avoided. Thus new flannel in female dress must not be associated with delicate coloured silk or satin, else a chameleon change may happen, even during the period of observation—a case that actually occurred.

Finding the insecurity of paper, we have recourse to parchment, to enrol our transfers, or our deeds of legal right. But modern parchment and vellum are very different things from ancient membranes bearing the same appellation. A smooth and glossy surface must needs be imparted now, and pipe-clay and other et-ceteras are duly summoned in for this purpose; and, in some cases, we have seen a thin pellicle united by no given tie whatever with the superficies it obscured. Now a moment's reflection will convince that, in such a case, the characters communicated must scale off on the first accession of damp, and leave the membrane unlettered and alone; and when an erasure is made, and pumice is applied, we, in such a case, write on the pumice, but certainly not on the membrane; and there is parchment so oily that it must needs be dusted with whiting, before a successful attempt to write upon it at all can be made, though, in other cases, it comes to hand already powdered, and a cloud of dust will arise from it whenever it is unfolded.

The commercial world some time ago experienced serious loses and inconvenience from frauds committed on bank checks, the signature being suffered to remain, while the sum described was discharged by acids or bleaching liquids, and sums of greater magnitude made to substitute their place. Robson, Brooks and Company, took out a patent for the application of a fugitive vegetable colour to the back of these checks, which was instantly changed and discharged by any acid application to the front; and such an invention answered the purpose remarkably well, and subserved the end proposed by it. Printing ink has been recommended as a counterforte, from its carbonaceous material, to the action of bleaching liquid, chlorine not having any power over carbon; but this kind of ink would not flow from the pen, and would stain writing-paper. The corrosive powers of sulphuric acid were also recommended, but such an application would burn out the letters, whether in reference to parchment or paper. Oxyde of manganese and indigo have been, in like manner, suggested; but the former, at any rate, could only be held in temporary mechanical suspension, and would soon be precipitated; and we know that sulphate of indigo is completely discoloured by solution of chlorine, or chloride of lime, and is even employed as a test of the comparative strength of bleaching liquids. I have made a great variety of experiments in search of a permanent ink, that might defy the effects of chlorine and the lapse of time; and the following ingredients I found most efficient in resisting the powers of acids: 1. Sulphate of iron, sulphate of indigo, and tincture of galls; 2. Nitrate of silver, nitrate of iron, and tincture of galls; 3. Nitrate of iron, nitro-muriate of gold, and tincture of galls. But the following ingredients and proportions I found triumphant over the most violent chemical agencies; and of its permanence in valuable records there can be no doubt whatever.

¼	ounce of	nitrate of silver in solution,	
1	do.	nitrate of iron	do.
¼	do.	prussiate of ammonia	do.
½	do.	tincture of galls.	

A portion of finely levigated Indian ink and gum arabic were added to these ingredients. The fluid ounce is to be here understood.

Writing-inks often contain many noxious ingredients. The recommended addendum of *corrosive sublimate* cannot be too severely censured, as children at school frequently suck their pens; and, in our boyish days, we can well remember to have seen some of our compeers who made no scruple of drinking the ink from the stand. *Sulphate of copper* is another adjunct, and evidence of our attainments in the scale of improvement; and this is the cause why the *penknife* is so promptly blunted in mending the pen —the sulphuric acid of the sulphate of copper, in virtue of its superior affinity, leaving its previous combination with the copper for the steel. We should venture to recommend the *carbonate of iron*, instead of its sulphate; as, in such a case, there would be no combining acid sufficiently powerful to evolve the chlorine, or gnaw the paper tissue. Carbonaceous matter, in the form of Indian ink, must always be the prerequisite of a durable and permanent ink.

CHAPTER IV.

ON THE DECAY OF MANUSCRIPT—RESTORATION OF ILLEGIBLE MANUSCRIPTS—PRESERVATION OF IMPORTANT DEEDS FROM THE DESTRUCTIVE EFFECTS OF DAMP—CONCLUSION.

IT would certainly be difficult to point out a question of greater importance than that connected with the decay of manuscripts, and especially of valuable records. The interests of kingdoms, communities, and individuals, are at stake. The rights of nations, the securities of the chartered privileges of cities, towns and estates, and those of universities, societies, and associations, are here equally involved; and state regency, the polity of governments, manorial rights, and insulated and combined immunities, are linked with the present inquiry. From regal and legislative interests, down to the revenue of the poor, does the question reach. Time past and time present, as bearing on the relations and conditions of futurity, in all the recorded value of a world's legend—its religion and its legislative acts—its judicature and civil polity, in all their precedents—the arts—literature and science, which add a lustre and renown to a nation's annals—all that exalts the human being above the brutes that perish, or the savage that roams through the desert, is here invaded and threatened with subversion and destruction.

The ink used in manuscripts, by the action of light and other agencies, is discharged in a manner very similar to that effected by chlorine: and the ink that withstands the latter will resist them. Where the letters have scaled off in films from vellum or parchment, in consequence of damp, &c. acting on the composition improperly applied to the surface of the membrane by the parchment or vellum manufacturer, it is obvious no restoration can ever be effected; such ink only as can chemically unite with the substance to which it is applied by one of its constituents, can, by possibility, be a permanent record, or run the scrutiny of time; for if a superficial film merely, time must and will detach it. But peroxide of iron, one of the constituents, indeed the basis, of common ink, integrates; and as this basis clings firmly to the surface, though the gallic acid, which gives it blackness, may decompose and decay, it is obvious that chemical means may be expected to reunite its constituent to gallic acid. Accordingly, various attempts have been made for this purpose, but with indifferent success. Sir CHARLES BLAGDON applied alternately solutions of iron and prussiate of potassa: and, with some modifications, these experiments were repeated by Sir HUMPHRY DAVY.

Some illegible manuscripts, I believe obtained from the Record-Office, were put into my hands for the purpose of making experiments upon them. In the first instance, prussiate, or ferrocyanate of potassa, was applied, by means of a sponge; and, as soon as it was completely dry, very dilute nitric acid was similarly passed over the surface. The manuscript was, in this case, restored of a *blue* colour. Ferrocyanate of ammonia will communicate a still deeper shade of blue, if substituted for the prussiate of potassa. I have also tried solution of chlorine instead of the nitric acid, but am inclined to give decided preference to the latter. The letters were restored to their primitive blackness by the substitution of tincture of galls for the ferrocyanate of potassa or ammonia, using, as in previous instances, the very dilute nitric acid, when the former had become dry.

But by far the most successful result was obtained in the following manner: Very finely powdered chlorate, or oxymuriate of potassa, was mixed with the tincture of galls, and applied *hot* to the manuscript, in the manner already stated, and, when dry, lime-water was passed over the surface. The application of the tincture of galls, combined with oxymuriate of potassa, may be repeated; and I should recommend those applications by means of a sponge, to be made in a manner similar to that of printing-ink to the types, in the case of the printing-press, rather than that the sponge should be wiped over the manuscript. The former experiments were my nearest approximations to the object of research, but the latter was quite conclusive and satisfactory. It is unnecessary, as indeed it would be useless, to detail my repetitions of the experiments of others, or the unsuccessful ones which occurred to me in the progress of the investigation.

No *deliquescent* substance or salt should enter into the composition of writing-ink; such, for instance, as muriates of lime or magnesia, &c. this last being combined with common salt, renders the exclusion of it necessary. Sugar, in like manner, must of necessity be excluded. Any deleterious substance, corrosive of the paper, must be avoided. Hence permuriate of mercury, or corrosive sublimate, though it has been used in ink, ought to be discarded, as it unites chemically with gelatine, as that of the parchment or vellum, and would of necessity destroy its tissue. It has indeed been suggested, that permanency might be given to manuscript by using sulphuric acid, *burning in the letters* by such means, but a moment's reflection must teach us that such a caustic material would, in a very short period, burn out the letters entirely, and they might as well be *punched out* at once. Gum is added to inks to suspend the colouring matter; and finely levigated charcoal might be a most important adjunct to writing inks; and a *gum resin*, dissolved in dilute alcohol, would be a valuable substitute for gum merely, because damp would not affect it, and it would form a cearment which would hermetically seal up the manuscript, and thus defend it from extrinsic agencies. It is probable that the inks of the ancients were formed of carbonaceous materials, though from what source obtained does not appear. The ink of the cuttle-fish, or finely levigated charcoal, mixed up with gum-water, and applied with a reed pen, seem likely to have been used; and a remarkable permanence has been stamped on such manuscripts, as in the case of the papyri found in the mummy cases, or those recovered from the ruins of Herculaneum, in which last the jet black far exceeds the brown black of the papyrus.

Every attention must be paid to the nature of the substance employed in the preparation of the vellum or parchment, and all deliquescent or corrosive ingredients must be discarded, or any thing that would, on chemical principles, counteract or decompose the ink; and last, not least, no veil or gloss should be thrown over the membrane, that could prevent chemical contact on the part of the ink with it. As this little work is entirely of a practical kind, and, discarding theory and speculation aims at usefulness through the medium of experiment, it may be here stated that I found the following a most interesting result. Paper was stained with acetate of iron, and, when completely dry, manuscript was communicated by writing on it with tincture of galls, having dissolved in it, at a temperature of 150° Fahrenheit, powdered gum-mastic. Such a record must needs be permanent, and may be safely recommended.

Damp is the circumstance that accelerates the decay of paper, membranes, and manuscript. This may be brought about by the dampness of the atmospheric medium, or the deliquescent character of the paper or parchment submitted to its action; or these may, by having been on ship-board, or exposed to marine influence on a sea-coast, be susceptible of hygrometric change, and become damp, as rock-salt weeps, when, by an attenuated atmosphere, its vapours condense and fall. I may mention, in conjunction with this question, that a valuable fur dress having been, from shipwreck, immersed in salt water, though carefully dried by stove-heat, was wont to abstract moisture so copiously from the atmosphere when the air became humid, that the water trickled plentifully from it. I found, however, that the application of solution of alum effectually cured it; the excess of acid in this bisulphate, by decomposing the deliquescent muriate, converted it into an efflorescent sulphate. In like manner, I have restored damp walls, by washing them with a solution of alum, the cause, in this case, being similar to the other; builders being too apt to use sea-sand in their mortar. I see no other method likely to be successfully operative in similar cases with paper or with parchment; the deliquescent salt must be decomposed, for, until this be done, frequent ablutions with fresh water will be of no use; but this method being practised in the first instance, immersion in fresh water, and subsequent drying in a stove, will be perfectly efficient.

I find that if linen or woollen cloth be immersed in water, saturated with *quicklime and sulphate of soda*, and then carefully dried, delicate steel instruments folded up in it, even if themselves damp, are effectually preserved from rust or oxidation. The rust of iron is found to contain a carbonate of that metal, and the aqueous particles of "wet" and "damp" are, it is proved, decomposed by the contact of iron at all temperatures, and with increased effect at an elevated one; hence the formation of rust or oxidation, &c. It is probable that the caustic lime not merely absorbs any minute quantity of carbonic acid gas present in the air, and by damp brought into more immediate contact and intimate union with the iron or steel, but also absorbs the first portions of present damp; perhaps too, and from a variety of experiments I have made on the subject, it is more than probable that lime may even take up oxygen. The efflorescent sulphate of soda does not attract humidity, but rather casts it off, and even its own water of crystallization. It is therefore evident that an envelope of cotton or woollen cloth, saturated as already described, would not only be a protection against damp in the case of steel or silver plate, but also prove of equal value for the preservation of important deeds and valuable manuscripts, whether on paper or parchment. It is probable that the vehicle of the encaustic paintings of the ancients was wax: and their works are wonderful monuments of permanence. Some analogous approximation may be made on the principle of the suggested application of a gum resin, dissolved in the tincture of galls. But a superficial film of transparent resin, dissolved in alcohol, might be communicated to the surface of the paper subsequent to that of the manuscript. Vegetable wax being only soluble in *boiling* alcohol, must, if esteemed preferable, be applied at that temperature.

I trust that the importance of the present inquiry will appear obvious to every one, as there are very few individuals but are fully persuaded that there is something wrong in the texture of our modern printing and writing papers, for they perceive that their books are crumbling to pieces among their hands, whereas their seniors evince no such tendency: this convinces us that it was not always so with books, and that the principles of decay have been infused at a period comparatively recent, and must be connected with modern manufacture. The question has too long slumbered, and the paper manufacturer continues to supply the market with paper so miserably bad in quality, that it is really a misnomer to call it *paper*. Much of the blame attaches to ourselves: we certainly have no right to prescribe a tariff of prices to the manufacturer, who must be the best judge of the prices at which he can afford to supply a genuine article; and a moment's reflection would convince us, that paper, composed of such materials as it ought to consist of, could not by possibility be disposed of on the terms at which some writing papers are offered to the public—say *fourpence* a quire; but alabaster costs only a penny per pound, and *chlorine-gas* will blanch any thing, however unfit for the purposes of paper, whether the stems of the holyhock, potato stalks, straw, hay, Indian corn leaves, or sawdust; and if the paper material is to be shred down to the very lowest scale of mechanical division, the fibre chopped to atoms and converted into mere pulp, where are the principles of cohesion, except they can be found in the size or glaze? And, even could such a discovery be made, the slightest damp would destroy its virtue, which at best is only superficial, and is proved in the fact of an erasure, when the ink acts as on unsized or blotting paper. Every person in the habit of writing on what is called "Bath-wove" paper, must be too sensible of what I complain of: and such papers have become so notorious for their bad qualities, that the stationer technically calls them "doctored." It may be well asked with astonishment, why this predilection for Bath-wove paper, and its unnatural and jaundiced complexion—its sickly yellow colour? To *persist in its use* is to encourage the evil already complained of, and so alarmingly increasing, as almost to threaten extermination to the cause of civilization. Blame has been put on the ink, and complaints on ink are frequently repeated, and universal; and, from preceding remarks, there is some ground for the charge, though by far the lesser evil; for, let an individual write with the same description of ink on Bath-wove and on "laid" or "wire" paper, and he will find, that in the former the ink becomes *brown*, and in some cases I have found the change immediate, while in the latter it maintains a jet-black colour.

If it be urged that I am an advocate for the manufacturer to hold out for high prices, I may merely say, that such an idea, were I capable of entertaining it, would be monstrous and absurd, and I wish to be sufficiently explicit to guard against any such assumption. I do not see why the paper manufacturer should not be fairly remunerated for a *genuine* article, and receive a just return for the employment of his capital and his intellect, in endeavouring to improve the paper-tissue, by availing himself of the aids of science; and, perhaps, the addition of manual labour besides; at any rate, the vicissitudes of business, and the risk of bad debts. There is, in these days of strenuous competition, sufficient to modify the profits of manufacture and preserve the natural level of price. These remarks must be considered as coming from me without suspicion: I have nothing to do with paper-making, either directly or indirectly; but I feel, in common with thousands, the evil and mischievous effects of the present system of the paper manufacturer, and am anxious to see an end put to the ruinous and fraudulent deterioration which, by a false species of economy, we have entailed upon ourselves.

The writer of a *billetdoux*, or a sonnet to "his mistress' eyebrow," may feel but little interested in the question; but with us and others there is something more than these to care for.

The tests requisite for the determination of the genuineness of paper, are not only simple, but of the easiest application. In order to detect the presence of the chlorine, the fatal bleaching agent, we have only, by means of a camel-hair pencil, to apply tincture of litmus, which should be of a fine blue colour, to the surface of the paper, which will soon be changed to *red;* and any vegetable blue colour, extracted by alcohol or spirit of wine, as those of the blue root of the radish, or the red cabbage, the blue petals of the iris, hyacinth, &c., all are changed to red, by being thus applied, if the "bleaching gas" has been used, and tells superficially, or is uncombined.

The combustion of the paper will, if carefully performed, discover to us the amount of *earthy* matter, as of gypsum or alabaster: thus, should 500 grains of paper consumed to ashes leave 60 grains of white earthy matter, it may be inferred that gypsum to nearly that amount exists in the specimen, or that the deterioration amounts to 12 per cent.

Some specimens of paper have been found to contain one-fourth their weight of gypsum. One specimen I discovered to possess fifteen per cent., Mr Brande states that he found in one case twelve per cent. The following is the method recommended by him for its detection: burn some paper in a platinum or earthen crucible, and continue the heat until the residuum becomes white, which it will readily do, if the paper be mixed with gypsum: the weight then will indicate the fraud. This conclusion, however, must be adopted with limitation, since I find the kind of rags employed may materially affect the question: thus if pure linen rags be alone employed, the earthy residuum should be merely fractional, but, if calico rags be used, the earthy ashes will be a considerable per-centage. Hence 100 grains of linen cloth consumed, left only 0.75 grains of earthy matter, while 100 grains of calico left 6½ grains of earth. It is obvious, therefore, that the kind of rag used in the pulp will somewhat interfere; but it is also evident, that if no earthy matter remain after combustion, the probabilities are all in favour of the paper being a genuine article, and exclusively made from linen. All above 7 grains for every 100 grains of paper consumed, may be considered as the result of a fraudulent admixture of gypsum or pipe-clay.

I found the following to be the amount of the relative weight of the earthy residuum of various writing papers after combustion :

100 grains of thick wove post, best quality,	4 grains.
Bath post, second quality,	6
wove post, worst quality,	9
thick laid post, second quality,	7
laid draft paper, second quality,	13
laid foolscap, third quality,	13
demy laid,	14

I much fear that though the evil complained of and lamented by the public is deeply felt, that a healthy change in the manufacture of our printing and writing papers is not to be expected from that quarter. It is a proverbial saying, that what is the business of every body, is that of none. If an individual be aggrieved alone, he seeks redress, because he is the exclusive individual injured. In the former case he is a fellow sufferer in common with thousands who share the same fate; and there is a divided, and, therefore, a more tolerable injury, and a general sympathy is awakened, in which he is only a participant. Besides, it requires the daring virtue of patriotism to stand forward in a common cause, and the question may be considered hopeless and irremediable, though it has been clearly shewn that it is a very tangible one, and the remedy sufficiently obvious.

A subject more imperiously demanding the interference of the legislature it were difficult to conceive. For these last six years it has, to my certain knowledge, been a rapidly progressive evil, and one of the most malignant and inveterate tendency. It has taken deep root, and is now rank and noisome. It threatens to sap our chiefest pleasures. Religion, the arts, science and literature, with united voice, declaim against it; and we firmly believe that nothing but a legislative act can arrest it in its progress, or stay its power. There is very properly an imposition of pains and penalties against the introduction of deleterious ingredients into beer and porter; and I do not see why the paper manufacturer should have perfect freedom to do as he chooses, and tamper with an article of the very first importance to our well-being. The produce of the brewer may be done without, but that of the paper manufacturer is essential to our existence in the scale of civilization, and decay and barbarism would follow its subtraction. Much of that trash which is called paper is an impudent forgery, and has nought of paper but the name. If gypsum and pipe-clay, and other improper ingredients are allowable in some substitutes for paper required for temporary purposes, as cursory memoranda, fugitive or ephemeral productions, or school-books, or scholar's writing tablets—be it so; but let not this be current without some mark of discrimination, that we may be able to select the good for permanent and valuable desiderata, and reject the bad. We want no more, and then should we, (thus put upon our guard and well informed,) from mistaken motives of economy, be induced, by the price, to adopt the bad, we have but ourselves to blame, and have a right to bear the loss unpitied. But, as things now stand, paper that is utterly worthless bears a sleek and glossy surface, and has withal so good an aspect, and so fair an exterior, that it tempts our purchase—its appearance bespeaks our suffrage in its favour, and we are only at length undeceived when time betrays the fatal secret. By a proper test, the imperfections and defects may be detected; and the authorities of Excise could easily be instructed to employ the proper means for this end, which are at once simple in themselves, and of the easiest application. Let competition in the market regulate the prices, but let us have the opportunity of purchasing a genuine paper if we choose to do it. At present we have no such power. We are deceived by a fair exterior, and become the unsuspecting dupes of our credulity; and should we offer a reasonable price for a genuine article, we are still at the mercy of the *ipse dixit* of the manufacturer, who may, for aught we know, be a man of inflexible integrity and sterling principle, but, for any thing we can tell, he may also be a man void of truth and honesty.

While we would not wish a British senate to interfere in the question of the price imposed by the paper makers, we do feel most anxious to welcome the period when the wisdom of our legislature shall secure to us a genuine paper. An inquiry into the question would substantiate its necessity, and their discriminating talent would, in good time, secure a remedy. We should not fear the result were the question once entertained. Paper being stamped LINEN, COTTON, MIXED, BLEACHED, UNBLEACHED, would be so many warrants to guide our choice, or beacons to warn us of our danger.—" *Quis vult decipi, decipiatur.*"

In the foregoing work, it has been my object to present the public with a faithful and condensed view of a most important question, and one in which every individual has a personal concern. For these several years I have watched with most painful interest and attention the advancing progress of the evil; and a conscientious conviction of the importance of the present discussion has engaged me in it—a position which will be granted me without difficulty or scruple, when it is stated I have no interest whatever to serve in this exposé but the public good. In the character of authorship I must be anxious for the low price of paper, for my volumes would cost me less; and should they go to pieces in the hands of purchasers, there are presses and paper in reserve for new editions. My earnest hope is, that my inquiries and investigations may lead to good, and not be fruitless; and I should hail the result as the happiest return that could crown my labours.

FINIS.

P. NEILL, PRINTER.